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TITLE: Investigation of Computer Software and Hardware in Surface and Underground Mining in Canada

Final Report
by

H.A. Simons (International) Ltd.
Consulting Engineers

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ABSTRACT

This report presents the results of an Investigation of Computer Software and Hardware in Surface and Underground Mining in Canada sponsored by CANMET and carried out by H.A. Simons (International) Ltd. during the period March 1984 to February 1985.

The investigation involved the mailing of a comprehensive questionnaire to 781 organizations across Canada, interviews with 16 institutions associated with the Canadian mining industry, and research of software directories, publications and vendor brochures.

There were 198 responses (25% of 781) to the questionnaire. One third of the responses were from mining and exploration companies. The majority of the participating organizations have over 10 years of mining, exploration, and research and development experience and use computers on a routine basis.

A total of 1,093 software modules or programs were identified in the responses to the questionnaire. The majority of these modules (45%) are applicable to exploration, mine design and development. The modules were evenly distributed between surface, underground, hard and soft rock mining. The participants developed 37% of the programs. Programs under research and development represented 17% of the modules. There were 241 modules reported as desired by the participants, 7% in Production Scheduling, 6% in Mine Planning and Design, and 5% in Mining Simulations.

A total of 298 modules were identified by method of program acquisition or access, with 53% purchased, 16% leased, 17% timeshared and 14% used on a service bureau.

Fortran was the programming language used for over 57% of the software modules categorized in the investigation. This was followed by Basic, Cobol, PL/I, and the remainder by RPG II, Pascal C and Assembler.

Overall about 60% of participants have or use computers, and about 80% of those categorized as mining and/or exploration companies. The largest group have one computer, 6% mainframe computers, 12% mini-computers and 11% micro-computers.

Research of software directories, publications and vendor brochures identified a total of 300 mining application programs commercially available. Their distribution by categories is very similar to the distribution of software modules identified by the questionnaire. Frequent applications of the commercial software were: 15% Mine Planning and Design; 12% Economic and Financial Analysis; 11% Exploration Data Management; 9% Mining Simulations; and 5% Environmental Monitoring.

There were 223 programs identified in the questionnaire with marketing options, 164 available for purchase, and 151 with option to lease. Most of these programs were among those included in the research on commercially available software.

In general the computer programs available on the market were found to be compatible with Canadian mining conditions. The compatibility is higher for hard rock mining, both surface and underground.

The investigation revealed a need for software in all phases of mining. In particular: a strong industry demand for short term mine planning; mine planning systems integrated with process simulation; three-dimensional dragline simulation; truck and shovel dispatch system; and orebody modelling with capability to handle complex geology.

A notable trend in computer applications in mining is the increasing use of micro computers for data entry and front end to mini-computers or to mainframes, for small engineering and survey programs, for engineering drawings, for interactive graphics, and for new applications such as underground ramp design.

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SOMMAIRE

Ce rapport représente les résultats de l'enquête effectuée par H.A. Simons (International) Ltd. entre Mars 1984 et Février 1985 sous le patronage de Canmet et couvrant l'utilisation d'ordinateurs et de logiciel dans les mines à ciel ouvert et souterraines, au Canada.

L'enquête débuta par un questionnaire détaillé expédié à 781 organismes à travers du Canada. Ceci fut suivi par l'entrevue personnelle de 16 compagnies ou enterprises engagées dans l'industrie minière Canadienne et finalement par l'étude des répertoires énumérant les logiciels et celle des publications et des dépliants publicitaires des fournisseurs.

Nous avons reçu 198 réponses (25% des 781) au questionnaire. Un tiers de ces réponses provient de compagnies minières ou d'exploration. La majorité des enterprises participantes possède à son actif un minimum de 10 ans d'expérience dans les domaines du développement, de la recherche et de l'exploration minière et utilise des ordinateurs sur une base routinière.

Les réponses au questionnaire ont permis d'identifier un total de 1093 modules de logiciel ou programmes. La majorité de ces modules (45%) s'applique à l'exploration, la disposition et la mise en valeur de la mine.

Les modules sont uniformément répartis entre les mines à ciel ouvert ou souterraines en roche dure ou tendre. Les participants ont développé 37% de leurs propres programmes. Les programmes concernant la recherche et développement représentent 17% des modules. Tel que demandé par le questionnaire, les participants ont rapporté 241 modules, soit 7% sur l'échelonnement de la production, 6% sur la planification et l'agencement de la mine et 5% sur la simulation.

Un total de 298 modules furent identifiés par le mode d'acquisition ou d'accès au programme, soit 53% d'achat, 16% de location, 17% de temps partagé et 14% d'un centre de traitement à façon.

Fortran fut le langage de programmation utilisé par plus de 57% des modules de logiciel énumérés par l'enquête, suivi par Basic, Cobol, PL/1 et finalement par RPGII, Pascal, C et Assembler.

Dans l'ensemble, environ 60% des participants et environ 80% des compagnies minières ou d'exploration possèdent ou utilisent des ordinateurs. La plupart possèdent un ordinateur, 6% des ordinateurs centraux, 12% des mini-ordinateurs et 11% des micro-ordinateurs.

L'étude des répertoires énumérant les logiciels, et celle des brochures ou publications de fournisseurs a permis d'identifier un total de 300 programmes applicables à l'industrie minière et disponibles, commercialement. Leur distribution par catégories est semblable à la répartition des modules de logiciel identifiés par le questionnaire. Les applications courantes de logiciels commerciaux furent: 15% planification et agencement de la mine, 12% analyse économique et financière, 11% gestion des données d'exploration, 9% simulation et 5% surveillance du milieu.

En réponse à la question couvrant la disponibilité commerciale 223 programmes ont été rapportés dont 164 sont vendus sur le marché et 151 peuvent être loués.

En général, les programes d'ordinateur disponibles commercialement sont compatibles aver les conditions des mines Canadiennes. Cette compatibilité est plus prononcée pour les mines de roche dure, à ciel ouvert ou souterraines.

Cette étude a révélé l'existance d'une demande de logiciels pour toutes les phases de l'exploitation minière et tout particulièrement pour les programmes suivants: une planification de la mine à court terme, systèmes de planification de la mine avec simulation du procédé, simulation en trois dimensions d'une drague traînante, systèmes d'acheminement par berlines ou pelle mécanique, modèlisation d'un gisement d'une géologie complexe.

Une tendance notable de l'utilisation d'ordinateurs dans l'industrie minière est l'emploi fréquent de micro-ordinateurs pour l'enregistrement des données et les calculs préliminaires devant être employés par des mini ou ordinateurs centraux. Cette utilisation s'applique également aux programmes d'arpentage ou courtes études, aux plans d'ingénierie, aux graphiques interactifs ainsi qu'aux applications nouvelles telles que l'étude de rampes d'accès souterraines.

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SUMMARY

Objectives

The investigation sponsored by CANMET and carried out by H.A. Simons (International) Ltd. during the period March 1984 to February 1985 was oriented to address the current status of computer applications in the Canadian mining industry and to identify computer software currently in use or available for application in Canadian mining conditions.

Scope

In the period from July to November 1984 a total of 718 questionnaires in English and 63 questionnaires in French were mailed out to mining and exploration companies, software vendors, universities, other educational institutions, federal and provincial government departments, consultants and others. In the last quarter of 1984, senior staff of 16 institutions were interviewed including universities, mining companies and software vendors. During the investigation, a literature research and a seminar were conducted on computer software available from international sources.

The responses to the questionnaire gave information on general categorization of the participants and of their computer hardware and software. Some 1,090 mining application software modules were identified and classified.

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Report Highlights

o Categorization of Participants

The total number of responses to the questionnaire was 198 or 25% of the 781 mailed out.

Approximately one third of the responses were from mining and exploration companies. Software vendors, consultants, government departments (federal and provincial) and universities represented respectively 13%, 11%, 9% and 3%.

The majority of the participating organizations have over 10 years of mining, exploration, and research and development experience and use computers on a routine basis.

o Computer Software

A total of 1,093 software modules were identified in the responses to the software portion of the questionnaire. These modules were broken down into the four categories as follows:

	No. of Modules	Percentage
Exploration, mine design and development	485	44%
Mine production	203	19%
Safety and environment	55	5%
Auxiliary processes	270	25%
Not classified	80	7%
Total	1,093	100%

o **Software Modules Wanted**

The respondents indicated a need for software in all four categories, but particularly in the areas of mine production and exploration/mine design and development.

The activities or applications more frequently requested were the following:

	No. of Occur-rences	Per-centage
Exploration, Mine Design & Development:		
- Mine planning and design	14	5.6%
- Graphics	11	4.6%
- Ultimate pit analysis	10	4.1%
Mine Production & Operations:		
- Production scheduling	17	7.2%
- Mining simulation	12	5.0%
- Drilling, breaking and cutting	10	4.1%
Auxiliary Processes:		
- Economic and financial analysis	11	4.6%
- Equipment maintenance	10	4.1%
Other; several applications, each one representing less than 3%	146	60.7%
Total	241	100.0%

o **Categorization of the Software Modules**

The distribution of programs or modules by area of application was as follows:

	No. of Software Modules
Underground mining - hard rock	409
Underground mining - soft rock	245
Surface mining - hard rock	486
Surface mining - soft rock	158

Some modules are applicable to both surface and underground mining, and/or to both hard and soft rock.

- **Categorization of the Software Modules** (Cont'd.)

Approximately 37% of the total number of software modules were developed by the reporting organizations, 18% were developed by others, and 45% were not categorized.

A total of 548 software modules were reported with details on Status of Program Development. Of these, 95, or 17% were on research and development phase; 40, or 7% on testing; 83, or 15% on limited production; and 330 modules, or 61% on full production.

The number of programs reported with details on Program Acquisition or Access was only 298. Of these 53% were purchased, 16% were leased, 17% used on timesharing basis and 14% used via service bureau.

The degree of user satisfaction for the software modules was as follows:

	No. of Software Modules	Percentage
High degree of satisfaction	339	40%
Medium degree of satisfaction	134	16%
Low degree of satisfaction	12	1%
Not specified	367	43%
Total	852	100%

The user evaluation of the support for the software modules was generally quite good, with an average of 221 modules (12%) receiving an overall good rating, 143 modules (13%) receiving a satisfactory rating, 22 modules (2%) receiving a poor rating and only 43 modules (4%) receiving no support. There were an average of 664 modules (60%) for which no user evaluation of support was given, these include 241 software applications reported as wanted or needed.

- **Categorization of the Software Modules** (Cont'd.)

  A large number of changes to the software modules were considered by the users. There were 342 modules (40%) being considered for upgrading, 33 modules (4%) being considered for replacement, and 178 modules (21%) not being considered for changes. There were 540 modules, including 241 modules wanted, for which no response was given.

- **Programming Languages**

  Fortran is the dominant language, being used for over 57% of the software modules. This is followed by Basic, Cobol, PL/I and the remainder, by RPG II, Pascal, C and Assembler.

  The majority of the software for the mainframe computers, was written in Fortran (81%), with the remainder written in Cobol, PL/I and Assembler. Some database or query languages such as Adabas, Natural and Mapper were also used.

  The majority of the software for the mini computers was also written in Fortran (56%), along with Basic (22%), Cobol (9%), and RPG (7%).

  The majority of software for microcomputers was written either in Basic (46%), or Fortran (16%).

Computer Hardware

- **Computers**

Almost 60% of participants have specified having or using computers. The mining and exploration companies are quite highly "computerized", 80% of companies reported having or using computers.

The occurrence of various sizes of computers within the mining group is very similar to the overall pattern; most of the computers are mini's and micro's.

Excluding the large number of organizations considered as not having a computer (41.9%), the next largest group was, expectedly, the group of organizations owning only one computer (28%).

The breakdown by the type of computer for organizations with one computer follows:

Type	Occurrence		Percentage of Occurrence	
	Mining	Total	Mining	Total
Mainframe	4	11	5.5	5.6
Mini	13	23	18.1	11.6
Micro	13	21	18.1	10.6
Total	30	55	41.7%	27.8%

- **Computers** (Cont'd.)

  Not shown in the questionnaires, but obtained from interviews and research is that some large organizations have many (more than 50) microcomputers, distributed throughout the organization. There are probably more microcomputers scattered throughout the medium and large organizations that are not reported in the questionnaires. Thus, the total for microcomputers is not very accurate and probably reflects the distribution in small and medium size organizations only.

  Of the organizations having a computer, 77% reported installation of auxiliary memory drives (mostly disks) and 50% installation of tape drives.

  The size of the auxiliary memory varies between less than 25 MB to more than 3,000 MB, the highest occurrence being in the group of the memory size up to 600 MB.

  Computers with tape drives mostly have one tape drive. Only 8.4% of them have more than 5 tape drives.

- **Communications**

  The number of organizations using communication equipment and lines is quite small; only 27% companies use modems or line drivers, and only 9% added multiplexors to their communication systems.

  Thirty-five percent of the surveyed organizations use communication lines. Most of these lines are dedicated lines, only small portion of lines are a part of a network system.

  Generally Gandalf equipment is the most frequently used communication equipment.

- **Local Area Networks (LAN)**

  Only 8% of organizations reported using Local Area Networks. Some organizations had several networks.

  Most of the networks use DEC computers as a host, followed by IBM and Prime computers. DEC and Prime owners use primarily the original equipment network systems (Decnet and Primenet respectively), IBM owners most frequently use the Ethernet and PCnet.

  The number of nodes varies from a low of 1 to a high of 40. The average seems to be 3 to 5 nodes.

- **Peripherals**

  Generally, almost every organization using a computer uses a printer to obtain a hard copy of computing results.

  The usage of plotters is significantly lower, only 51%.

  The digitizer was added to the system by 34% of the organizations and CRT's or graphic workstations by 68% of organizations.

  There were not many organizations reporting the use of specialized peripherals. Most of those reported were for peripherals associated with graphic capabilities or displays, some were array processors.

Research on Commercial Computer Software

A total of 300 commercial computer software modules for mining applications were identified and categorized using the same breakdown used for the questionnaire modules.

The distribution by categories of commercial software modules is almost identical to the distribution of software modules identified in the responses to the questionnaire.

Commercial Software Modules by Category	No. of Software Modules	Percentage
Exploration, mine design and development	131	44%
Mine production	53	18%
Safety and environment	37	12%
Auxiliary processes	74	25%
Not specified	5	2%
Total	300	100%

The distribution by area of application produced results very similar to the questionnaire results:

Area of Application	No. of Software Modules	Percentage
Underground - hard rock mining	101	15%
Underground - soft rock mining	149	23%
Surface - hard rock mining	179	27%
Surface - soft rock mining	222	34%
Not specified	5	1%
Total	656	100%

Research on Commercial Computer Software (Cont'd.)

The most frequent applications of the commercial software identified in the research were:

	No. of Software Modules	Percentage
Exploration, Mine Design and Development:		
- Data management	34	11%
- Mine planning and design	46	15%
Mine Production:		
- Mining simulation	27	9%
- Material transport	9	3%
Safety and Environment:		
- Environmental monitoring	14	5%
Auxiliary Processes:		
- Economic and financial analysis	37	12%
Other	167	56%
Total	300	100%

Marketing Options

It is assumed that all the 300 software modules identified in the research on commercial software are available for purchase and/or lease. The sources of information (brochures, directories, etc.) used for the research do not specify marketing options in detail.

Responses to the Questionnaire

The responses to the questionnaire reported a total of 223 programs or software modules available in the international market with options for purchase, lease, timeshare or service bureau. This total represents 20% of the 1,093 modules identified in the investigation. The majority of the computer programs in this category were also included in the 300 modules identified in the research on commercial software.

Responses to the Questionnaire (Cont'd.)

The distribution by marketing options of the software modules reported in the questionnaire is as follows:

	No. of Modules
Option to purchase	164
Option to lease	151
Option to timeshare	66
Option to service bureau	109

Several software modules were reported available with more than one option. The total number of marketing options reported available is 490.

Compatibility With Canadian Mining Conditions

In general the computer programs available on the market are compatible with Canadian mining conditions. The compatibility is higher for hard rock mining, surface and underground. Commercial programs or modules for coal mining are also compatible with the Canadian operations on the prairies and in the coal deposits of Nova Scotia. These programs, with the exception of those based on cross-sectional modelling, are not applicable to the structurally deformed coal deposits of the foothills and Rocky Mountain regions.

Software Research and Development

The participants in the investigation questionnaire and/or interviews reported 95 computer programs in the research and development phase, 8.7% of the 1,093 programs identified by the investigation.

Software Research and Development (Cont'd.)

The distribution of software modules in research and development by categories is shown in the following table:

Category	No. of Modules and Percentage Currently On R & D	Wanted R & D	Total	%
Exploration, mine design and development	34	7	41	43.2%
Mine production	22	9	31	32.6%
Safety and environment	1	4	5	5.3%
Auxiliary processes	14	4	18	18.9%
Total	71	24	95	100.0%

Summary of Trends & Areas of Interest For Development

The respondents to the questionnaire and the organizations interviewed indicated a need for software in the following categories:

- Exploration, mine design and development;
- Mine production;
- Safety and environment;
- Auxiliary processes.

The total number of software modules reported as desired by the participants is 241.

Some highlights of the trends and areas of interest for development are listed:

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Summary of Trends & Areas of Interest For Development (Cont'd.)

- **Long and Short Term Mine Planning** - There is a strong industry demand for short term mine planning package. Mine operators in particular want very specific solutions. Short and long term mine planning systems should be interactive in operators' opinion.

- **Integrated Mine Scheduling System** - A mine planning software system that can integrate mine scheduling with mineral processing simulations is desired by operators and engineering companies.

- **Three-Dimensional Dragline Simulation Software** - There is a demand for development of a three-dimensional dragline simulation program.

- **Truck and Shovel Scheduling and Dispatch System** - There is a need for truck and shovel scheduling and dispatch systems.

- **Open Pit Haulage System** - A simulation model for an open pit haulage system has been developed. Recent enhancements are on linear programming (LP) dispatching algorithm.

- **Orebody Modelling** - There is a demand for very general graphical modelling of deposits with capability to handle complex geology.

- **Micro-computers for Front End or Small Problems** - There is a definite interest in using a micro-computer for data entry and small database applications.

Summary of Trends & Areas of Interest For Development (Cont'd.)

- **Engineering Drawings on Micros** - There is an interest in implementing CADD systems based on micros.

- **Downloading Systems to Micros** - Some vendors and universities are downloading as much software as possible to micro-computers.

Recommendations For the Next Survey

There are some recommendations for the continuation of the investigation of computer applications in the mining industry.

The first recommendation is to extract and expand on cross-correlations of the information in the database, created by the 1984 investigation, which were not elaborated because of budget limitations. A number of participants provided detailed information on computer software with sufficient material to study, in depth, the areas with the greater need of computer software development.

To promote participation in the investigation, the questionnaire should be oriented to few very specific areas or disciplines in such a way that one specialist per participating organization can respond to the whole questionnaire. Questionnaires with multiple choices should always be used to avoid ambiguity in the responses.

ACKNOWLEDGEMENTS

The contribution of numerous individuals in the mining industry is greatly appreciated. It is hoped that this document will give valuable service to all those that have interest in computer applications in mining and that the generous contributions of all those that helped review drafts, arranged interviews and filled out the investigation questionnaire can be projected for the benefit of all the mining industry.

Special thanks to Mr. Dave Muir, Muir & Associates Computer Consultants Inc., for his contribution of talent and enthusiasm.

LIMITATION OF THE INVESTIGATION

The computer applications in the mining industry today are numerous. This investigation is not intended to represent a complete listing of computer programs or users. Within limitations of time and budget, a comprehensive mailing list was prepared for the investigation questionnaire, and literature research was conducted on commercially available software.

It was not the intention of CANMET or Simons to miss any of the organizations or products not contacted or included in this investigation.

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INTRODUCTION

This report on the Investigation of Computer Software and Hardware in Surface and Underground Mining in Canada was prepared by the Mining & Mineral Processing Division of H.A. Simons (International) Ltd., Vancouver, B.C. authorized by the Department of Supply & Services, Contract DSS File No. 15SQ23440-3-9202. The contract was initiated under the Short Term Assistance in Research and Technology (START) program. It was under the technical direction of Simons' Mining & Mineral Processing Division. Mr. V. Srajer and Mr. R. Boyle were the Scientific Authorities for The Canada Centre for Mineral and Energy Technology (CANMET), Department of Energy, Mines & Resources, Canada. Simons' project team included R. Espinoza, Project Manager, F. Foster, J. Martinez, M. Mezihorak, D. Muir, D. Pepper, A. Thom, W. Thomas, P. Wong and others.

This report is a summary of the work recently completed as part of this contract during the period March 28, 1984 to February 28, 1985.

The Investigation

In recent years there has been a growing need to improve productivity in operating mines in Canada due to the increase of competition in international markets and lowering of commodities prices.

The Investigation (Cont'd.)

The Canadian mining industry faces the challenge of not only having to overcome the cost of operations in cold weather and high costs due to long overland transportation of its products and supplies but also to improve the efficiency in all aspects of production and management to compensate for the low ore grade of current mining operations and for the higher costs of labor, taxation and environmental protection than that experienced by several foreign mineral producers.

Computer applications in the mining industry began a significant growth in the early 1960's and have since become increasingly widespread in operations, consulting and research. Numerous programs are being utilized in all facets of the mining industry with a trend to increase the magnitude and complexity of the tasks handled by computers. This trend has been bolstered in recent years by the more efficient design and lower purchasing prices of the computer hardware.

Several mining operations have installed minicomputers, dedicated to mining engineering and mine management functions, independently of the companies' mainframe computers which are primarily used for payroll and accounting data processing.

As an alternative to minicomputers, a number of organizations are interested in the potentials of the microcomputers for mining, exploration, graphics and monitoring applications.

The Investigation (Cont'd.)

Because of the general conditions described and the complex nature of the mining activity, including mineral exploration, there has been an increasing demand for the application of computer technology as a tool for the identification, and more accurate modelling and evaluation of mineral deposits; analysis and optimization of long and short term mine planning; economic analysis and feasibility studies of mining projects and operations; resource data management; safety and environmental monitoring and studies; and for specialized engineering disciplines as geostatistics, rock mechanics, equipment selection and maintenance, and others.

Scope

The investigation sponsored by CANMET on computer applications in mining in Canada is oriented to investigate the current status of the computer technology applications in the Canadian mining industry and to identify programs currently in use or available, and which are compatible with Canadian mining conditions.

The investigation as delineated by CANMET included the following tasks:

- To provide information on inhouse computer software and hardware in the Canadian mining industry including the respective staff.

- Identify computer software available on the international market compatible with the Canadian mining conditions.

Scope (Cont'd.)

- Identify current research and development efforts in computer software for application in surface and underground mining.

- Identify short and long range needs for computer software development for application in surface and in underground mining.

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INVESTIGATION PROCEDURES

The major tasks involved in the development of this investigation can be listed in the following categories:

1) Development of a comprehensive list of companies and institutions of the Canadian mining industry.

2) Selection of a sample of 500 names from all sectors listed in paragraph 1) for mailing a questionnaire.

3) Design of a questionnaire that would provide information on:

   - The participating companies and computer staff.
   - Mining applications computer software, research and development.
   - Computer hardware.
   - Computer software and hardware purchase intentions and comments.

4) Research of pertinent database systems, directories, publications and previous survey investigations.

5) Compilation of all the information gathered in a database system with sufficient capacity as needed to contain all different categories of information.

6) Reporting, display and analysis of the results of the investigation.

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List of Sources

The list of sources of information used for the research on computer software available on the international market and for the survey mailing list follows.

Source	Area
Directory of The Engineering Mining Journal	Mining, exploration and consulting companies - Canada, U.S.A., U.K., Australia and South Africa.
CIMM Survey on Computer Applications in Mining	Mining companies and institutions in Canada.
Rocky Mountain Resources Database	Software vendors, authors - Canada, U.S.A., U.K., Australia and South Africa.
The International Software Database	Software vendors - U.S.A.
Compendex Database	Software mining companies, consultants, government agencies, universities - Canada, U.S.A., U.K., Australia, India and South Africa.
Coal Age Magazine	Software vendors - U.S.A.
Data-Tech. Skelly & Loy Company	Software vendors - Canada and U.S.A.
Canadian Data System List	Software vendors and authors - Canada.
Computer Search	Software
Mining Asscciation of Canada	Mining, exploration and consulting companies - Canada.
Coal Association of Canada	Mining, consulting, construction companies and institutions - Canada.

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List of Sources (Cont'd.)

Source	Area
Association of Consulting Engineers of Canada	Engineering and consulting companies - Canada.
Canadian Mining Handbook, The Northern Miner	Mining and exploration companies - Canada.
Southam Publications Mailing List - Mining	Mining, exploration, consulting companies, universities and government agencies - Canada.
Directory of Government Agencies, Federal and Provincial	Government agencies and departments - Canada.
Prosystems, Ontario Mailing List	Mining, exploration and consulting companies - Ontario.
CANMET's Scientific Authority selected mailing list, Messrs. V. Srajer, R. Boyle and Dr. B. Das.	Mining, exploration and consulting companies and vendors - Canada, Australia, France, U.K. and South Africa.
Simons' staff selected mailing list	Mining, exploration, consultants and vendors - Canada, U.S.A. and U.K.

Miscellaneous marketing brochures and vendors.

Questionnaire

In order to ensure maximum response and clear information from the participants, a preliminary questionnaire was designed and reviewed with selected participants.

The list of professionals that participated in the reviewing and testing process of the questionnaire includes but is not limited to:

- Mr. W. Burton, P.Eng., Chief Engineer, Bullmoose Mining Co.
- Mr. E. Nunn, P.Eng., Senior Mining Engineer, Lornex Mining Corporation.
- Mr. L. Teichgraber, P.Eng., Consultant.
- Mr. T. Ireland, P.Eng., Consultant.
- Dr. B. Das, past Chairman of CIM Computer Application Section.
- Mr. B. Hancock, P.Eng., Senior Mining Analyst, Cominco Ltd.
- Mr. J. Tosney, P.Eng., Mining & Engineering Manager, Saskatchewan Mining & Development Corp.
- Mr. A. Veld, Manager Information Services, Suncor Inc.
- Mr. J. Martschuck, P.Eng., Senior Mine Superintendent, Suncor Inc.

The questionnaire was designed to collect information on:

- Operating Mines, Engineering Firms, Universities:
  - hardware
  - software
  - people
  - outside services used
  - corporate profile
  - mining profile
  - long term and short term needs in software development

Questionnaire (Cont'd.)

o Software in Use:

- purpose
- scope
- limitations
- methods
- languages
- transferability
- ownership
- availability
- recommended improvements

o Software Status:

- Research and development phase
- Test phase
- Limited production
- Full production (including documentation)

The final questionnaire and an introductory letter in both official languages from CANMET's Director General, Dr. W.G. Jeffery, are shown in Appendix 1A.

The mailing list sources are listed in Section "List of Sources".

Simons' project team produced a classification by priorities of all listed companies and/or institutions in order to secure within the first 500 names the potential participation of companies with recognized relevance in computer applications in mining. Appendix 1B shows total number of questionnaires mailed by country/province.

Later, to compensate for permanent and summer closures and relocations, the number of questionnaires mailed out was extended to 781 including 63 French version questionnaires.

Questionnaire (Cont'd.)

Mailing lists were checked for duplications and to ensure inclusion of different sectors of the mining industry and different regions.

For the major mining/exploration companies or institutions, it was decided to send questionnaires to operating mines or units and to head offices in order to obtain information at different levels of the corporations.

Introductory letters were personalized using names and addresses of the executives of the listed companies. By indication of CANMET, questionnaires were mailed including prepaid return envelopes.

From July 20 to November 10, 1984 a total of 718 questionnaires in English and 63 questionnaires in French were mailed out.

Interviews

A program of interviews with a limited number of organizations was carried out considering the following aspects in the selection.

- Willingness to participate
- Geographic location
- Size of the organization
- Type of computer hardware and software
- Industry segment/mining profile

All information obtained in the interviews was tabulated and compiled with the investigating questionnaire results.

The following organizations and staff were interviewed:

- University of Alberta
  Department of Mineral Engineering
  Edmonton, Alberta

  Interviewer: J.R. Martinez
  Interviewees:
  - Dr. T.S. Golosinski, P.Eng.
  - Dr. W. Griffin

- Ecole Polytechnique
  Montreal, P.Q.

  Interviewers: D. Muir and V. Srajer
  Interviewees:
  - Mr. F. Soumiss
  - Mr. J. Thier

- Queen's University
  Kingston, Ontario

  Interviewers: D. Muir and V. Srajer
  Interviewees:
  - Dr. P. Calder
  - Dr. K. Notley
  - Dr. D. Farahmand
  - Mr. K. Fytas

Interviews (Cont'd.)

- Alberta Power Limited
  Edmonton, Alberta

  Interviewer: J.R. Martinez
  Interviewees:
  - Mr. K.M. Bellows, P.Eng.
  - Mr. J. Kayande, Supervising Eng'r., P.Eng.
  - Mr. D. Wedman, Senior Eng'r. & Mining Eng'r.

- Inco Ltd.
  Copper Cliff, Ontario

  Interviewers: D. Muir and V. Srajer
  Interviewees:
  - Mr. D.J.F. Danko, Sup't. Systems Development
  - Mr. R.W. Garinger, Supervising System Analyst

- Lornex Mining Corporation Ltd.
  Logan Lake, B.C.

  Interviewers: D. Muir, R. Espinoza and W. Thomas
  Interviewees:
  - Mr. E. Nunn, P.Eng., Senior Mining Engineer

- Noranda Mines Ltd.
  Information Systems Division
  Toronto, Ontario

  Interviewers: D. Muir and V. Srajer
  Interviewees:
  - Dr. R.W. Stobie, Ass't. Manager
  - Mr. J. Gibson, Eng. Analyst

- Noranda Research Center
  Montreal, P.Q.

  Interviewer: D. Muir and V. Srajer
  Interviewees:
  - Mr. P.S. Campbell, Engineer

Interviews (Cont'd.)

- Manalta Coal Ltd.
  Calgary, Alberta

  Interviewer: J.R. Martinez
  Interviewees:
  - Mr. E. Rychkun, Manager Tech. Information Systems

- Suncor Inc.
  Resources Group
  Oil Sands Division
  Fort McMurray, Alberta

  Interviewer: J.R. Martinez
  Interviewees:
  - Mr. A. Veld, Mgr. Technical & Eng. Systems

- Suncor Inc.
  Resources Group
  Resource Development Division
  Calgary, Alberta

  Interviewers: J.R. Martinez and G. Zahary
  Interviewees:
  - Mr. D.B. Cross, Sr. Minerals Geologist
  - Mr. J.H. Shilabeer, Chief Eng'r. Mine Dev't.

- Control Data Corporation
  Vancouver, B.C.

  Interviewers: R. Espinoza, P. Wong and V. Srajer
  Interviewees:
  - Mr. D. Graham, P.Eng.
  - Mr. F. Jansen, P.Eng., Branch Manager

- Dataplotting Services Inc.
  Toronto, Ontario

  Interviewers: D. Muir and V. Srajer
  Interviewees:
  - Mr. W. Parker, President
  - Mr. G. Teed, Vice President Operations
  - Mr. R. Hawkins, Project Manager

Interviews (Cont'd.)

- Geomin, Computer Services Corporation
  West Vancouver, B.C.

  Interviewers: D. Muir, R. Espinoza and V. Srajer
  Interviewees:
  - Mr. S.W. Houlding, P.Eng.
  - Mrs. M.A. Roberts, Geologist

- Martson & Martson
  The UMA Group
  Vancouver, B.C.

  Interviewers: R. Espinoza and J. Martinez
  Interviewees:
  - Mr. R.W. Kenway, Executive Vice President

- Monenco Consultants Ltd.
  Calgary, Alberta

  Interviewers: J. Martinez and G. Zahary
  Interviewees:
  - Mr. I. Muirhead, Manager Mining Division
  - Mr. A.M. Scott, Chief Mining Engineer
  - Mr. J.E. Dragner, Specialist Eng. Computer Systems
  - Mr. M. Wise, Mining Engineer

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Research on Commercial Computer Software

Research of software available in the international market was developed using several sources which included:

- The International Software Database
- Compendex Database
- Data-Tech. Skelly & Loy Company
- Computer Search
- Dialog
- CIMM Survey on Computer Applications
- Coal Age Magazine Directory
- U.S. Bureau of Mines, Directory of Computer Programs
- U.S. Dep't. of Commerce, National Technical Information Service, Directory of Computer Programs
- CANMET, Coal Laboratories, Calgary, File on Software Vendors
- H.A. Simons File on Software Vendors

The research was oriented to identify and classify the software available on the market using the questionnaire format for organization and software module detailed classification.

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DATABASE MANAGEMENT

In order to handle the data from the survey responses, an efficient and flexible computer database management system has to be utilized for the study. Simons selected the Datatrieve system by Digital Equipment Corporation to store and manipulate the response data.

Datatrieve is an inquiry language and report writing system that provides direct, easy access to any data contained in files.

There are three alternatives to store data in the Datatrieve system:

- Using indexed files and a large single domain containing records with all individual data fields.

- Using indexed files and several smaller divisions, each containing only a portion of the data fields from each record.

- Using sequential files and a single domain containing records with all individual data fields. A domain by definition is simply a complete set of records that have the same record fields as record definitions.

The second alternative was selected for the study because of simpler and faster data entry, correction and manipulation.

MAB 78-388-82

Data from each returned survey questionnaire, i.e. a complete record, was stored separately in four domains:

- General - information
- Software - module
- Hardware - peripheral
- Purchase - intention

In the General - information domain, there are 86 individual data fields, while Software - module, Hardware - peripheral, and Purchase - intention domains contain 85, 126 and 86 data fields respectively. Using an identical key field in each domain, i.e. an assigned serial number to each returned questionnaire form, these four domains are interconnected and become a complete record of a single questionnaire response.

INVESTIGATION RESULTS

General

The total number of responses to the questionnaire is 198, or 25% of the total of 781 mailed out. This result indicates the interest in the investigation demonstrated by the most sectors of the Canadian mining industry and the success of the decision to extend the closing date for responses compilation.

Categorization of Participants

Approximately 36% of the responses are from the mining and exploration companies. Software vendors and consultants represent, respectively, 13% and 11% of the total. Government departments, and universities represent 9% and 3% respectively. There are 16, or 8% of the total of 198 responses, other type participants. The total number of participants not indicating type of organization is 40 or 20%. See Figure No. 1.

The distribution of participants by location is shown in Figure No. 2. A total of 96 participants, or 49% are in head offices. Branch offices, and plant/mine locations represent approximately 15% and 14% respectively.

The majority of the participating organizations (40%) have a workforce of more than 100 employees. Participants with less than 100 employees represent approximately 31%. A total of 57 participants, or 28% did not indicate payroll size. See Figure No. 3.

Figure No. 4 shows the distribution of participants by the size (payroll) of parent or subsidiary companies out of Canada. Organizations with over 500 employees total 20, or 10%. A total of 138 participants did not fill out the question.

Figure No. 5 shows the distribution of participants by a number of locations in Canada. Approximately one half of the responses reported one location. A total of 57, or 29% did not specify the number of locations.

Figure No. 6 shows the distribution for operating mines in Canada. Approximately 56% of the responses did not elaborate on number of mines, 26% reported one or more operating mines and 18% reported none.

The distribution of participants by operating mines worldwide is shown in Figure No. 7. A majority of participants, 82% did not elaborate. Ten participants, or 5% answered having 4 to 10 mines worldwide.

Figure No. 8 shows the distribution of participants by the type of mining - hard rock and soft rock mining. In hard rock mining, a total of 33 participants, or 17% is in underground and 27, or 14% is in surface operations. In soft rock mining, a total of 9 participants, or 5% is in underground and 23, or 12% is in surface.

The distribution by the years of mining experience of the participating organizations is shown in Figure No. 9. The majority (90, or 45%) had more than 10 years of experience and 45, or 23% had more than 20 years. The distribution by exploration experience shows similar characteristics. See Figure No. 10.

The experience of the participating organizations in research and development is shown in Figure No. 11. A total of 118, or 60% did not answer this question. Approximately 27% indicated experience of more than 10 years.

A majority of participants (134, or 68%) reported use of computers (see Figures No. 12 and 13), of these 111, or 56% use the computers on a routine basis, 17, or 9% reported partial use and only 6 participants, or 3% reported rare use. A total of 17 participants, or 9% reported not using computers and 47, or 24% did not answer the question.

The information on computer personnel staffing in participating organizations is shown in Table I "Breakdown of Computer Personnel" and Table II "Distribution of Computer Personnel by Training".

Computer Software

The results of the investigation on mining application software were obtained from the analysis of the responses (1,093 in total) to the questionnaire mailed to various sectors of the Canadian mining industry, and from the interviews with 16 organizations.

A total of 1,093 software modules were identified and categorized using a Datatrieve domain specially created for this purpose. The information on software modules was extracted from the 198 responses to the questionnaire and from the information obtained from interviewed organizations. The information obtained during the interviews was tabulated using the same questionnaire form.

The participating organizations cooperated in the investigation by filing separate forms for each software module. A record number of 36 forms was sent by one of the leading organizations in mining computer applications. The cooperation given by the mining companies was noteworthy.

Categorization of Mining Application Software

A total of 1,093 software modules were included in the software portion of the questionnaire*. These software modules were broken down into four categories as follows:

Category	Total (Inclusive)	Wanted
Exploration, mine design and development	485 (44%)	92
Mine production	203 (19%)	78
Safety and environment	55 (5%)	17
Auxiliary processes	270 (25%)	54

The remaining modules (80, or 7%) were not classified by the respondents and no details were given. See Figure No. 14.

The software modules are assigned according to the area of application as follows:

Underground mining	- hard rock	409 (23%)
Underground mining	- soft rock	245 (14%)
Surface mining	- hard rock	486 (28%)
Surface mining	- soft rock	458 (26%)
Not specified		158 (9%)

Several software modules are applicable to both surface and underground mining, or to both hard and soft rock, producing a total number of applications of 1,756. See Figure No. 15.

* Of those 241 were the software modules that organizations would like to have ("wanted").

Exploration, Mine Design and Development

The distribution of software modules in the Exploration, mine design and development category is shown in Table III and in Figure No. 16. The classification was given by the participants in most cases. For those not classified modules, if the capability of more than one category existed, the more sophisticated function was used for the classification. The database contains unprocessed information on modules with the capacity for more than one category classification.

The Exploration, mine design and development category contains approximately one half (44%) of all the software modules reported on by the participants. This proportion is exactly the same as the results on commercially available computer software, as can be seen in Figure No. 28.

Distribution of modules within this category shows an almost equal percentage for data management (14%), graphics (11%), and mine planning and design (11%) functions. The total number of data management modules can be increased using some modules grouped in other sub-categories, which have a secondary function of data management.

Mine Production

The Mine production category distribution is shown in Table IV and in Figure No. 17. Here again, the percentage (18%) of the total number of modules in this category is identical to the distribution produced from the research data on commercially available software. See Figure No. 29.

Mining simulation (including draglines, dispatch, underground coal mining, etc.) and production scheduling are the most frequent functions in this group, with 18% and 16% respectively. The other functions, with the exception of material crushing (5%), have occurrences between 8% and 11%. An important 38%, or 78 modules were reported as wanted or needed by the participants in this group. The frequency distribution is as follows:

Function	Number of Modules Required
Production scheduling	17
Mining simulation	12
Drilling, breaking and cutting	10
Material loading	9
Production recording	7
Production reporting	7
Material transport	5
Other (monitoring, reclamation)	4

Safety and Environment

The distribution of software modules within the Safety and environment category is shown in Table V and in Figure No. 18. The number of modules in this category is 55, or only 5% of the total of 1,093 modules. This percentage is less than half of the percentage obtained from the research data on commercially available software (12%). This difference can be partially explained by the fact that the Canadian mining industry has a smaller percentage of underground coal mines than the U.S.A. and Europe. The distribution of required modules is as follows:

Function	Number of Modules required
Ventilation	7
Roadway support	4
Face support	3
Environmental monitoring	2

The modules classified as ventilation, environment monitoring and face support (including hydraulic props, slope control) are the most frequent with 19, 14 and 12 occurrences or 35%, 25% and 22% of this group total (includes both "have" and "need" modules).

Auxiliary Processes

The distribution of modules in the auxiliary processes category is shown in Table VI and in Figure No. 19. This Figure also shows that this category has about the same percentage (25%) as the research data on commercially available software. In this category the most frequent functions are economic and financial analysis (19%), and soil and rock mechanics (17%). Engineering calculations (flow diagrams) and equipment maintenance (preventive) show 12.6% and 12.2% respectively, of the total group of 270 modules. In this category the total number of "needed" modules is 54, or 20% (Table VI).

Categorization of Software Modules by Development

o Source of Development

The total of 1,093 software modules were classified according to the source of development. A total of 402 modules or 37% of the total was reported as developed inhouse by 124 of the 198 total participants. The percentage of modules developed by the users increases approximately to 47% if the modules reported as "needed" (241) are subtracted from the total (classified as 'not specified'). Figure No. 20 shows the distribution of software by source of development.

- **Method of Development**

  A total of 443 software modules were reported with details on the method of development. Approximately 66% (294 modules) are original programs, not developed from previous software. A total of 81 modules, or 18% was developed with major modifications from previous software and 18 modules, or 4% with minor modifications. A total of 50 modules were developed from previous software but no detail was given on the degree of modifications. Figure No. 21 shows this distribution.

- **Status of Program Development**

  The majority of the software modules were classified as being in full production (330 out of 547), including documentation. There were 83 (15%) classified as being in limited production, 94 (17%) were classified as being in research and development phase, and only 40 (7%) were classified as being in the testing phase. The remaining 547 (50% of total) were not specified. See Figure No. 22.

Categorization of Software Modules by Degree of Applicability

The majority of the software modules, 206, or 43% were classified as being of a high degree of general applicability, 157, or 33% as being of some generalization and 114, or 24% as of local (specific, unique) application. There were 375 modules, that is 44% of the 852 identified total (1,093 less 241 of "needed" modules = 852), that did not provide information on the degree of applicability. See Figure No. 23.

Categorization of Software Modules by Acquisition or Access

For programs that were not developed in house, the majority of the modules, 158 (53%) were purchased, 47 modules (16%) were leased, 51 modules (17%) were used on a timesharing basis, and 42 modules (14%) were used via a service bureau. Of the total of 1,093 modules, 402 were developed inhouse, 201 were developed by others, 241 were reported as "needed" and 249 did not provide details on method of acquisition or access. See Figure No. 24.

Categorization of Software Modules by Evaluation of Support

Approximately 54% (463) of the 852 software modules reported to be in use included information on evaluation of support. The distribution of the evaluation of support is shown in the following table.

Percentage of Total Reply	None	(%)	Poor	(%)	Satisfactory	(%)	Good	(%)	Total	(%)
Documentation	8	(1)	30	(4)	203	(24)	222	(26)	463	(54)
Training	74	(9)	21	(2)	119	(14)	202	(24)	416	(49)
Consulting	46	(5)	15	(2)	107	(13)	239	(28)	407	(48)

Classification of Software by Degree of User Satisfaction

The tabulation of results on the question about the degree of user satisfaction follows:

	Number of Modules	Percent
Low degree of satisfaction	12	1
Medium degree of satisfaction	134	16
High degree of satisfaction	339	40
Not specified	367	43
Total number of modules reported	852	100
Number of modules needed	241	N/A
Total Number of Modules	1,093	100

Classification of Software Modules by Marketing Options

A total of 41 organizations responded affirmatively to the marketing options. The number of modules thus offered accounted to 223. The distribution of options for acquisition or access of these programs is as follows:

Total number of modules reported available: 223

Options Available	Number of Modules	Percentage of Total 852 Responses
Purchase	164	19%
Lease	151	18%
Timeshare	66	8%
Service bureau	109	13%
Not specified	629	74%

The number of modules listed for marketing with support in documentation, training and technical consulting is 208, this total is slightly lower than the total number of modules offered, 223. The supporting services were reported by the same number of organizations marketing the software, 41 in total.

The support available is shown in the table below. It should be noticed that the total number of modules with some type of support is greater than the number of modules reported available in the market. This is possible since more than one organization can be marketing services for the same program.

Total number of modules reported with support: 208

Type of Support Available	Number of Modules	Percent
Documentation	199	95
Training	197	95
Technical consulting	197	95

Most of the organizations listing supporting services of documentation, training and consulting, reported the three types of services on an equal basis. Only 34 modules, or 16% were offered without complete support and only 3 modules were listed without documentation.

The majority (53%) of the purchase or lease clients were reported to be located out of Canada, the other 47% of the total of 182 clients are reported as being located in Canada. The following table indicates the distribution by the number of clients per program:

Total reported number of purchase/lease clients: 182.
Total reported number of other users: 112.

Number of clients per program:		
	1 to 5 clients	58%
	6 to 20 clients	23%
	21 to 50 clients	17%
	Over 51 clients	2%
	Total	100%

- **Programming Languages**

  - Fortran is the dominant language, being used for over 57% of the software modules. This is followed by Basic with over 19%, Cobol with 7%, PL/I with 3%, RPG II with 3% and the remainder by Pascal, C and Assembler (1% each). See Figure No. 26.

  - Approximately 27% of the Fortran language used was Fortran 77, and 22% of the Basic language used was specified as HP Basic.

- **Programming Languages by Computers Used**

  - The distribution of computer languages by computer is shown in Table VII.

  - The majority of the software for the large computers such as Amdahl, IBM, CDC, Sperry/Univac, DEC and Honeywell mainframe computers, was written in Fortran (81%), with the remainder written in PL/I (8%), Cobol (6%), and Assembler (2%). Some database or query languages such as Adabas, Natural and Mapper were also used (2%). One system used APL.

  - The majority of the software for the minicomputers was also written in Fortran (56%), along with Basic (22%), Cobol (9%), and RPG (7%). The IBM S/34, 36, 38's mainly used RPG II and Cobol, while PDP 11's mainly used Fortran and Macro 11. The larger HP machines mainly used Fortran, while the smaller HP's usually used Basic. The C language was only used on the DEC VAX computers (1%). Assembler language was also used on most mini's (2%).

- The majority of software for microcomputers was however written in Basic (46%), along with Fortran (16%), Pascal (7%), Cobol (4%), and Coral (11%). A large number of modules did not specify a language (12%). Other languages used were Assembler and Ladder Logic (for programmable controllers).

o **Operating Systems**

- The majority of the software on the large mainframes ran under the usual host operating system as follows:

- IBM large	- CMS, MVS
- IBM medium	- VM/SP, SSP, OCL
- Amdahl	- MTS, MVS
- CDC	- NOS
- Sperry	- OS1100, CSTS
- Honeywell	- GCOS
- NCR	- VRX

- The software on the minicomputers ran under various operating systems, the usual host operating systems are as follows:

- DEC VAX	- VMS
- DEC PDP11	- RT-11, RSX-11M
- IBM	- SSP, OCL
- HP	- MPE, RTE, Basic O/S
- Prime	- Primos
- Data General	- AOS
- Honeywell	- GCOS
- TI	- DX10
- Wang	- VS

- The software on the microcomputers ran under various operating systems, the usual host operating systems are as follows:

- DEC	- MS-DOS, POS
- IBM	- PC-DOS
- Apple	- Apple-DOS
- HP	- Basic O/S, MS-DOS, Internal, Pascal O/S
- TI	- MS-DOS
- North-Star	- DOS, CP/M
- Misc.	- MS-DOS, CP/M

Software Transferability

The computer program transferability aspect was discussed in most interviews with computer staff of the 16 visited organizations, which include mining companies, research departments, universities, consultants and software vendors.

It is a general opinion that the transferability of software from one system to another is not a major problem, especially in those cases where the programming language is Fortran (approximately 57% of the questionnaire responses).

It is estimated that the effort or cost to transfer Fortran programs is normally about 20% of the purchase price. In those cases where programs written in Basic or some other languages were required to be transferred to systems using Fortran, the cost was estimated to be a large percentage of the program purchase price.

Systems Software

The responses to the questionnaire on Systems software section were classified in categories and sub-categories arranged by alphabetical sorting of names and/or vendors. Lists are shown in Appendices 4A to 4C. The lists were structured as follows:

- **Category 1** - Application Support Libraries, Appendix 4A

  Sub-categories:
  - Statistics
  - Mathematics
  - Device-independent graphics
  - Device-specific graphics

- **Category 2** - Device Support Software, Appendix 4B

  Sub-categories:
  - Graphics device driver
  - Communications/network
  - Terminal controller
  - Queue support

- **Category 3** - Data Management Software, Appendix 4C

  Sub-categories:
  - Database management system
  - Data dictionary
  - Query language
  - Archiving
  - Backup and restore

Software Purchase Intentions

The section of the questionnaire on Software purchase intentions was answered only by 32 participants, or 16%. This result can be interpreted as a consequence of the difficult times being faced by the mining industry, as well as the desire to maintain confidentiality on this type of information.

The sparse information provided in the questionnaires was tabulated as follows:

System Software Purchase Intentions - number of responses:

		Purpose			Time (Months)		
Description	Qty.	Expand	Replace	Add	<6	6-12	>12
Compiler	13	7	3	4	7	3	1
Editor	5	4	1	2	3	1	1
Applications supp.	15	11	3	9	8	7	3
Device support	12	7	1	9	6	6	2
Data management	12	11	1	4	8	2	3
Other software (1st)	11	5	2	7	6	3	1
Other software (2nd)	4	1	1	2	2	2	1

Appendix No. 5 shows a list of questionnaire participants' general comments on purchase intentions regarding computer software and hardware.

Computer Hardware

The total number of organizations included in our questionnaire amounted to 198. Of them, 72 (that is 36.4%) were organizations involved in mining and/or mining exploration activities ("mining organizations"). A number of organizations, 83 (41.9%) in total, did not fill out the hardware portion of the questionnaire. For the purpose of our investigation, we have assumed that these organizations do not have or do not use computer hardware inhouse.

All the percentage calculations are based on the total sample of 198 organizations, including those which did not fill out the hardware portion of the questionnaire.

We would also like to mention that the names and abbreviations of the manufacturers and equipment models appear herein were in the form as listed in the returned questionnaires. Only obvious misspelling corrections were made during the data entry into computer files. Summaries were made by grouping obviously similar equipment.

Computers

A total of 115 participants, or 58.1% have specified having or using computers. Of the organizations not using or having computers, the mining and exploration companies total 14 or 20%. Of these, 4 were interested in purchasing some computer hardware in the near future.

The occurrence of various sizes of computers within the mining group is very similar to the overall pattern; most of the computers are mini's and micro's. The ownership of micro's prevails in the mining group.

Computers (Cont'd.)

Excluding the large number of organizations considered as not having a computer (41.9%), the next largest group was, expectedly, the group of organizations owning only one computer (27.8%). There were 8.1% of the organizations with 4 or more computers. The mining group is generally more "computerized" (80%, compared with overall 58%, participating organizations reporting a computer). However, most of the mining organizations (42.0%) have only one computer, predominantly mini or micro.

Not surprisingly, our survey indicates that the "big" computer manufacturers hold the largest share of the market.

Computer	Manufacturer Ranking Position Overall	 Mining
Mainframe	IBM CDC Sperry	IBM Sperry Honeywell
Share of Total	74.4%	75.0%*
Mini	DEC HP IBM	DEC HP IBM
Share of Total	76.8%	86.4%*
Micro	IBM HP Apple	IBM HP Apple (tied with Atari, Northstar, Radio Shack & Data General)
Share of Total	64.4%	69.0%*

Computers (Cont'd.)

* Not shown in the questionnaires, but obtained from interviews and research is that some large organizations have many (more than 50) micro computers, distributed throughout the organization. There are probably more micro computers scattered throughout the medium and large organizations that are not reported in the questionnaires. Thus, total for micro computers is not very accurate and probably reflects the distribution in small and medium size organizations only.

Of the organizations having a computer, 76.5% reported installation of auxiliary memory drives (mostly disks) and 50.4% installation of tape drives. The numbers for the mining group are 82.1% and 42.9% respectively.

The size of the auxiliary memory varies between less than 25 MB to more than 3,000 MB, the highest occurrence being in the group of the memory size up to 600 MB. Only 6% occurrences were in the group ranging more than 3,000 MB.

The majority of computers with tape drive (67.4%) have one tape drive. Only 8.4% of them have more than 5 tape drives.

Communications

The number of organizations using communication equipment and lines is quite small; only 53 companies (26.8% of total surveyed) use modems or line drivers, and only 18 (9.1%) added multiplexors to their communication systems. The usage is a little higher in the group of mining and exploration companies, where the respective numbers are: 23 companies (32% of all mining) use modems and line drives; and 12 organizations (17.1% of all mining) have multiplexors installed.

Communications (Cont'd.)

70 of the surveyed organizations (35.4%) use communication lines. Of them, 35 (50%) are mining and exploration organizations. Most of these lines are dedicated lines (809 lines), a small number of lines are part of a network system (350 lines). Obviously there are companies using both direct dialing system and dedicated lines. Percentage-wise, mining and exploration companies use more dedicated lines and dial-ups and are less associated with the network systems than the rest of the companies.

Transmission rates for most of the communication equipment are between 1,200 and 4,800 bps.

There is a large number of manufacturers and models on the communication equipment market. In our investigation, the majority of the equipment was by the following manufacturers:

Manufacturers	**Modem and Line Drives**	
Bell	94	20.1%
Gandalf	75	16.0%
General Data	73	15.6%

Manufacturers	**Multiplexors**	
Sperry	51	37.8%
Gandalf	45	33.3%
Micom	9	6.7%

Note: Some of these results are partly distorted by including individual companies with a large number of identical equipment (Bell, Sperry).

Generally, we feel that the Gandalf equipment is the most frequently used communication equipment in our survey.

Local Area Networks (LAN)

Only 16 organizations (8.1% of total surveyed) reported using LAN. Some organizations had several networks, while the total number of networks reported was 21. Of them, 7 (10% of total in the group) were mining and exploration organizations.

Most of the networks use DEC computers (7) as a host, followed by IBM and Prime computers (4 each), the other host computers are Sperry, Wang, HP, TI and unspecified (6 in total). DEC and Prime owners use primarily the original equipment network systems (Decnet and Primenet respectively), IBM owners most frequently use the Ethernet and PCnet.

The number of nodes varies from a low of 1 to a high of 40. The average seems to be 3 to 5 nodes.

SIMONS

COMPUTERS

The surveyed organizations own or use a total number of 224 computers. The distribution is as follows:

Type	Quantity Total	Quantity Mining & Exploration	Distribution Total	Distribution Mining & Exploration	Mining Portion of Total
Main frame	39	13	17.4%	13.0%	33.3%
Mini	112	45	50.0%	45.0%	40.2%
Micro	73	42	32.6%	42.0%	57.5%
Total	224	100	100.0%	100.0%	44.6%

The following table lists the occurrence of computer systems by the size of main memory.

Main Memory

Size (kB)	Occurrence	% of Total
< 64	23	10.3%
64 - 128	13	5.8%
128 - 256	24	10.8%
256 - 512	28	12.5%
512 - 1,000	28	12.5%
> 1,000	81	36.2%
"Not specified"	27	12.0%
Total	224	100.0%

The size of the computer main memory is usually associated with the size of computer. The following table shows the occurrence of computers by the size.

Computer Size	Occurrence	% of Total
Micro	73	32.6%
Mini	112	50.0%
Mainframe	39	17.4%
Total	224	100.0%

Total sample: 198 organizations.

Company Has	Type	Occurrence Total	Occurrence Mining	% of Total Total	% of Total Mining	Mining Portion of Total
1 computer	Mf*	11	4	5.6%	5.5%	36.4%
	Mini	23	13	11.6%	18.1%	56.5%
	Micro	21	13	10.6%	18.1%	61.9%
	Total	55	30	27.8%	41.7%	54.5%
2 computers	Mf	2	-	1.0%	-	-
	Mf & Mini	3	-	1.5%	-	-
	Mf & Micro	1	-	1.5%	-	-
	Mini	6	3	3.0%	4.3%	50.0%
	Mini & Micro	8	4	4.0%	5.5%	50.0%
	Micro	8	4	4.0%	5.5%	50.0%
	Total	28	11	14.1%	15.3%	39.3%
3 computers	Mf	1	-	0.5%	-	-
	Mf & Mini	5	1	2.5%	1.4%	12.5%
	Mf/Mini/Micro	-	-	-	-	-
	Mf & Micro	1	1	0.5%	1.4%	100.0%
	Mini	2	1	1.0%	1.4%	50.0%
	Mini & Micro	6	4	3.0%	5.5%	66.7%
	Micro	1	1	0.5%	1.4%	100.0%
	Total	16	8	8.1%	11.1%	50.0%
4 and more	Mf	-	-	-	-	-
	Mf & Mini	6	2	3.0%	2.8%	33.3%
	Mf/Mini/Micro	3	3	1.5%	4.2%	100.0%
	Mf & Micro	-	-	-	-	-
	Mini	2	-	1.0%	-	-
	Mini & Micro	4	2	2.0%	2.7%	50.0%
	Micro	1	-	0.5%	-	-
	Total	16	7	8.1%	9.7%	43.8%
None or no response	-	83	16	41.9%	22.2%	19.3%
TOTAL NO. OF ORGANIZATIONS		**198**	**72**	**100.0%**	**100.0%**	**36.4%**

* = Mainframe

COMPUTERS (Cont'd.)

Auxiliary Devices

Number of Units per Computer	Auxiliary Memory Devices: Tape Drives Occur.	% of Total	Disk Occur.	% of Total	Bubble Occur.	Other Occur.	% of Total	Auxiliary Memory Size (MB)	Occur.	% of Total
1	64	67.4%	59	41.3%	-	1	14%	<25	45	27.1%
2	15	15.8%	34	23.7%	-	5	72%	25-600	48	28.9%
3	4	4.2%	18	12.6%	-	-	-	620-2600	30	18.1%
4	2	2.1%	9	6.3%	-	-	-	>3000	6	3.6%
5	2	2.1%	4	2.8%	-	-	-	Not spec.	37	22.3%
6 - 10	6	6.4%	12	8.4%	-	-	-			
11 - 20	1	1.0%	4	2.8%	-	1	14%			
Over 21	1	1.0%	3	2.1%	-	-	-			
TOTAL	95	100.0%	143	100.0%	-	7	100%			

Number of organizations having an auxiliary memory device: 88 (76.5% of organizations having a computer).
Of these: mining and exploration organizations: 46 (82.1% of mining and exploration organizations having a computer).

Number of organizations having a tape drive: 58 (50.4% of organizations having a computer).
Of these: mining and exploration organizations: 24 (42.9% of mining and exploration organizations having a computer).

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Mainframe Computers

Manufacturer	Model	Occurrence Total	Occurrence Mining & Exploration	% of Total Total	% of Total Mining
CDC	Cyber	2	-		
	Cyber 70-73	1	-		
	170	1	-		
	820	1	-		
		5	-	12.8%	
Sperry/Univac	1100/61	2	-		
	1100/72	1	-		
	1100/81	1	-		
	1100/80	1	-		
	1100	1	1		
	1110	1	1		
		7	2	17.9%	16.7%
IBM	4341	4	1		
	3081	3	1		
	3083	2	-		
	4381	2	1		
	4300	2	-		
	4341-1	1	-		
	4341-2	1	1		
	4361	1	-		
	3033	1	-		
	370	1	1		
	33XX	1	-		
		19	5	48.7%	41.7%
DEC	2060	2	1		
	20	1	-		
		3	-	7.7%	8.3%
Honeywell	DPS8	2	2		
	64/50	1	-		
		3	2	7.7%	16.7%
NCR	V-8555	1	1	2.6%	8.3%
Amdahl	V7/B	1	1	2.6%	8.3%
Total Mainframe Computers		**39**	**12**	**100.0%**	**100.0%**

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Mini Computers

Manufacturer	Model	Occurrence Total	Occurrence Mining & Exploration	% of Total Total	% of Total Mining
IBM	Sys. 34	9	5		
	Sys. 36	4	2		
	Sys. 23	1	-		
	Sys. 38 M5	1	1		
	5360	1	1		
	5340	1	1		
	Ser. IR	1	-		
		18	10	16.1%	22.7%
DEC	VAX 11/780	10	1		
	VAX 11/750	7	2		
	PDP 11/70	6	2		
	PDP 11/23	4	2		
	PDP 11/34	3	3		
	PDP 11/45	2	2		
	PDP N	2	2		
	VAX 11/750 & 11/780	1	-		
	PDP 11/44	1	-		
	PDP 11/03	1	1		
	PDP 11 Integr.	1	-		
	VAX II/785	1	-		
	VAX 11/730	1	-		
		40	15	35.7%	34.1%
HP	3000	7	3		
	1000	3	1		
	3000/44	2	1		
	9000	2	-		
	3000/68	2	2		
	3000/48	1	1		
	3000/40	1	-		
	9920	1	1		
	9845	1	-		
	9845B	1	1		
	9020 A5-X2	1	1		
	3000-III	1	1		
	1000/A90	1	-		
	1000/21 MX	1	-		
	21 MX (9600)	1	-		
	A900	1	-		
	"No model given"	1	1		
		28	13	25.0%	29.6%

Mini Computers (Cont'd.)

Manufacturer	Model	Total	Occurrence Mining & Exploration	% of Total Total	% of Total Mining
Prime	750 HP	7	1		
	850	2	-		
	450	2	-		
	500	2	-		
		13	1	11.7%	-
Data General	MV 8000-10000	1	-		
	MV 4000	1	-		
	C-330	1	-		
	S/130	1	-		
		4	-	3.6%	-
Wang	VS 100	1	1		
	VS 90	1	-		
		2	1	1.8%	2.3%
NCR	9020	1	1		
	8271	1	1		
		2	2	1.8%	4.5%
Honeywell	DPS6	2	2		
	L6	1	-		
		3	2	2.7%	4.5%
TI	990/10	1	1	0.9%	2.3%
Four Phase	IV/65	1	-	0.9%	-
Total Mini Computers		**112**	**44**	**100.0%**	**100.0%**

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Micro Computers

Manufacturer	Model	Occurrence Total	Occurrence Mining & Exploration	% of Total Total	% of Total Mining
IBM	PC	18	12		
	PC-XT	4	4		
		22	16	30.0%	38.1%
HP	9845	3	2		
	9816	3	-		
	150	3	1		
	85	2	1		
	9000	1	1		
	1000	1	1		
	150/4	1	1		
	75	1	1		
	9826	1	-		
	9020	1	1		
	41CV	1	-		
	"No model given"	2	2		
		19	11	26.0%	26.2%
Apple	II C	3	-		
	III	1	1		
	II+	1	-		
	LIZA	1	1		
		6	2	8.2%	4.8%
Radio Shack	TRS 80	1	1		
	TRS 80-II	1	1		
		2	2	2.7%	4.8%
DEC	Rainbow	2	-		
	"No model given"	1	1		
		3	1	4.1%	2.4%
Northstar	"No model given"	2	2	2.7%	4.8%
Data General	PRO 350	2	2	2.7%	4.8%
Gleynare	67002	1	-		
	6580	1	-		
		2	-	2.7%	-
TI	PC	1	-	1.4%	-

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Micro Computers (Cont'd.)

Manufacturer	Model	Occurrence Total	Occurrence Mining & Exploration	% of Total Total	% of Total Mining
NEC	PC 8001	1	1	1.4%	2.4%
Access MTX	-	1	-	1.4%	-
Commodore	64	1	-	1.4%	-
Superbrain	-	1	-	1.4%	-
OEM	MC 800	1	-	1.4%	-
Wang	PC	1	-	1.4%	-
Atari	800	2	1		
	800 XL	1/3	1/2	4.1%	4.8%
Foxboro	Fox-3	1	1	1.4%	2.3%
Hyperion	-	1	1	1.4%	2.3%
Allen Bradley	-	1	-	1.4%	-
Heath	H89	1	-	1.4%	-
"No name given"	"No model given"	1	1	1.4%	2.3%
Total Micro Computers		**73**	**42**	**100.0%**	**100.0%**

SIMONS

COMMUNICATIONS EQUIPMENT

Modems and Line Drivers

Manufacturer	Baud Rate	Models	Occurrence	% of Total
Gandalf	1,200	LDS 125, SAM 212, SAM 212A	34	7.2%
	2,400	LDS 309, PIN 9103	13	2.8%
	4,800	404, 125, 140	8	1.7%
	9,600	SM II, LDS 309, LDS 120, SM 9600, MIE-M103, MLDS	20	4.3%
		Total	75	16.0%
Hayes	1,200	Smart Modem 1200	12	2.5%
Data General	300	103-A3	1	0.2%
	1,200	DE-1, 212, T212A	25	5.3%
	2,400	T212A	6	1.3%
	4,800	208, T212A	37	7.9%
	9,600	T209	4	0.9%
		Total	73	15.6%
Bell	300	103	6	1.3%
	1,200	212, 212A	66	14.1%
	2,400	201C, 4201, T208	22	4.7%
		Total	94	20.1%
Racal/Vadic	300	Phone Modem	1	0.2%
	1,200	212A, VA3413, VA3434, P200	10	2.2%
	2,400	Comlink 4	2	0.4%
Racal/Milgo	9,600	GMS 9601	2	0.4%
		Total	15	3.2%
Rixon	1,200	TA201C, 212A/202T	5	1.1%
	4,800	208, 212A	6	1.3%
	9,600	209	4	0.8%
		Total	15	3.2%

Modems and Line Drivers (Cont'd.)

Manufacturer	Baud Rate	Models	Occurrence	% of Total
Quebec Tel.	2,400	Multic II	1	0.2%
	4,800	Multic II	1	0.2%
		Total	2	0.4%
Anderson-Jacobson	300	A242A	1	0.2%
	1,200	A31212ST	2	0.4%
	9,600	Accustic Cplg.	4	0.9%
		Total	7	1.5%
ESE	1,200	212A	2	0.4%
	2,400	8200	4	0.6%
		Total	6	1.3%
CCG	300	103A	4	0.8%
	2,400	Dataphone	1	0.2%
	9,600	"Not given"	4	0.9%
		Total	9	1.9%
Paradyne	4,800	MP48	60	12.8%
	9,600	MP96	6	1.3%
		Total	66	14.1%
Prentice	2,400	SLMK II	1	0.2%
Develcon	2,400	DS 513	19	4.1%
ATT	1,200	212A	10	2.1%
Sperry	9,600	DCM	14	3.0%
Codex	9,600	6200	12	2.6%
Attel Data	9,600	T212	16	3.4%
Universal	2,400	SYS	2	0.4%
N.W. Tel.	2,400	-	2	0.4%

Modems and Line Drivers (Cont'd.)

Manufacturer	Baud Rate	Models	Occurrence	% of Total
Sangamo	2,400	TA 201C	1	0.2%
TI	300	700	1	0.2%
Co Data Systems	2,400	224	2	0.4%
N. Telecom	1,200	212A	1	0.2%
Concord	2,400	V22 BIS	2	0.4%
Cermeler	1,200	Infoma 212A	1	0.2%
Electronic	1,200	Ven-Tel	3	0.6%
Glenayre	1,200	DPSK	1	0.2%
GE	1,200	VA212-LC	2	0.4%
Sask. Tel.	1,200	212A	1	0.2%
Weston Elec.	9,600	200096A	2	0.4%
"Not given"	4,800	-	3	0.6%

The total number of modems and line drivers is 468. Their distribution by the baud rate is as follows:

Baud Rate	Occurrence	% of Total
300	14	3.0%
1,200	175	37.3%
2,400	78	16.7%
4,800	115	24.6%
9,600	86	18.4%
>9,600	0	0.0%
Total	468	100.0%

The number of organizations having modems and line drivers is 53 (26.8%). Of them, 23 (43.4%) are mining and exploration organizations (32% of the total surveyed mining organizations).

SIMONS

Multiplexors

Manufacturer	Model	Number of Channels	Occurrence	% of Total
Gandalf	9101, 9103	8	28	20.7%
	SM9600-D	16	4	3.0%
		24	12	8.9%
	Compacx	32	1	0.7%
	Total		45	33.3%
Micom	Micro 800, 4800/2	4	5	3.7%
	M8828	8	2	1.5%
	U800	16	2	1.5%
	Total		9	6.7%
Timeplex	T-16	4	2	1.5%
	-	8	2	1.5%
	-	16	2	1.5%
	Total		6	4.5%
HP	12040BM, 39301A	8	8	5.9%
Sperry	8609	16	51	37.8%
Paradyne	-	3	2	1.5%
	-	4	2	1.5%
	2698	8	2	1.5%
	Total		6	4.5%
Axis Tech.	-	7	1	0.7%
Motorola	8	2	2	1.5%
Dynapack	DP 1000	8	2	1.5%
ATT	Dataphone	4	1	0.7%
Codex	-	32	2	1.5%
DEC	D211	16	1	0.7%
ENA	-	12	1	0.7%

Multiplexors (Cont'd.)

The total number of multiplexors is 135. The distribution by the number of channels is as follows:

Number of Channels	Occurrence	% of Total
Up to 4	14	10.4%
5 to 8	45	33.3%
9 to 16	61	45.2%
17 to 24	12	8.9%
25 to 36	3	2.2%
	135	100.0%

The number of organizations having multiplexors is 28 (14.1% of total surveyed). Of them, 12 (42.9%) were mining and exploration organizations (17.0% of total mining and exploration organizations).

COMMUNICATION LINES

Distribution of communication lines is as follows:

Access Speed (Baud)	Dial-ups	Dedicated Lines	Network
300 - 1,200	403	263	168
2,400 - 4,800	130	263	125
9,600 and Up	9	283	57
Total	542	809	350
Total no. of Organizations	55 (27.8%)	53 (26.8%)	20 (10.1%)
Of them: mining and exploration	23 (31.9%)	25 (34.7%)	5 (6.9%)

The number of organizations having communication lines is 70 (35.4%). Of them, 35 (50%) were mining and exploration organizations (49% of total mining and exploration organizations).

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LOCAL AREA NETWORKS (LAN)

The number of organizations using "LAN" is 16.

Network Name	Number of Nodes	Host Computer Manufacturer	Model
Decnet	28	DEC	PDP and VAX
	14	DEC	2060
	3	DEC	DMP-118
Sperry	-	Sperry	1100/81
MB Testnet	-	DEC	VAX
Tentime	-	DEC	VAX 11/780
Wangnet	2	Wang	VS 100
Qaleng	1	DEC	780
Eagle	1	DEC	730
PC-Net	3	IBM	PC
Ethernet	40	IBM	PC
P/Ringnet	2	Prime	750/500
P Net/X25	3	Prime	750/450/45
3780 Proto	"Not specified"		
Bell	"Not specified"		
IBM 3270	1	IBM	370
HP SRM	5	HP	9826
Primenet/R	2	Prime	750/500
Primenet/X	3	Prime	750/450/45
"No name given"	5	IBM	8100
"No name given"	5	TI	990/10

Total number of "LAN" is 21. Of that number:

7 (33.4%) use DEC computer as a host.
4 (19.0%) use IBM computer as a host.
4 (19.0%) use Prime computer as a host.
6 (28.6%) use other computers as a host.

Only 16 organizations, that is 8.1%, of the total of 198 reported using a "LAN". Of them 7 (3.5%) were mining and exploration organizations (10% of the mining group). Their share of the number of "LAN" was 62.5%.

PERIPHERALS

Printers

Generally, almost every organization having a computer uses a printer to obtain a hard copy of computing results. In total, 93 (30.9% of total organizations using computers) organizations reported using a printer, 46 of them (82.1% of total mining group with computers) are mining and exploration organizations.

The number of printer manufacturers and printer models is enormous, however a few organizations seem to hold quite a large share of the surveyed sample. They are:

Manufacturer	Share of Total Printers in Survey
DEC	36.9%
Honeywell	14.4%
IBM	10.8%
HP	6.0%

The most common models are DEC LA 120 and Honeywell PRU 7075.

Plotters

The occurrence of plotters is significantly lower than that of printers. Only 59 (51.3% of companies using computers) reported using a plotter, 24 of them (42.9% of total mining group with computers) are mining and exploration organizations.

This specialized and expensive equipment is being manufactured by few manufacturers. The most common manufacturers in our survey are:

Plotters (Cont'd.)

Manufacturer	Share of Total Plotters in Survey
HP	36.2%
Calcomp	29.8%

Most of the companies prefer HP models 7475 and 7585 and Calcomp model 960.

CRT's and Graphic Work Stations

In total, there are 1,194 CRT's and graphic work stations distributed among the 78 surveyed organizations, 35 of them are from the mining and exploration group. Only 67.8% of all and 62.5% of mining and exploration organizations report having this kind of equipment.

Again, there is a large number of manufacturers, however the most common are:

	Share of Total in Survey	
Manufacturer	All	Mining & Exploration
IBM	21.4%	19.0%
DEC	23.3%	9.1%
Sperry	9.1%	17.5%
HP	8.1%	16.2%

The most common models are DEC VT181, Sperry UTS 20/20W and IBM 3278.

Digitizers

Of all organizations using a computer, 39 (33.9%), added a digitizer into their system. In the mining and exploration group these numbers are 20 and 35.7%.

The largest digitizer representation in the survey is held by two major manufacturers:

Manufacturer	Share of Total in Survey	
	All	Mining & Exploration
Calcomp	33.8%	36.1%
Summagraphics	19.8%	33.3%

The model names were not clearly identified in the questionnaire returns.

Tape Drives

50 organizations reported installation of tape drives. This number represents 43% of the total organizations using a computer. The respective numbers for mining and exploration organizations are 20 organizations, which is 35.7% of the total.

The most frequent manufacturers are:

Manufacturer	Share of the Total Tape Drives
Sperry	19.7%
DEC	18.8%
HP	18.8%
IBM	10.3%

The most common models are Sperry model 434, DEC TE16, HP 7070E and IBM 3420.

Specialized Peripherals

The surveyed organizations reported miscellaneous specialized peripherals. Most of them were equipment associated with graphic capabilities and diskette drives. One organization reported special equipment for "slope monitoring systems".

Printers

Manufacturer	Model	Occurrence	% of Total
IBM	5224	7	
	5256	6	
	3203-5	6	
	5225	5	
	3262	4	
	5211	4	
	5240	3	
	3287	1	
	3211	1	
	Various	8	
	Total	45	10.8%
DEC	LA 120	106	
	LW 100	17	
	LA 100	6	
	LP 50	5	
	LA 12	3	
	LP 11	2	
	LP 05	2	
	LP 26	2	
	P2R Points	2	
	LA 180	1	
	LP 27-UA	1	
	LP 100	1	
	LA 36	1	
	LA 34	1	
	LN 01	1	
	DW IV	1	
	LP 15	1	
	Decwriter	1	
	Total	154	36.9%

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Printers (Cont'd.)

Manufacturer	Model	Occurrence	% of Total
HP	2631B	4	
	2631A	3	
	2608A	2	
	2608S	2	
	829608	2	
	9866B	1	
	2611A	1	
	2930	1	
	2631G	1	
	2932A	1	
	Thermal Printer	1	
	Various	6	
	Total	25	6.0%
Epson	MX 100	12	
	FX 80	4	
	LQ-1500	1	
	Various	5	
	Total	22	5.3%
Honeywell	PRU 7075	55	
	7007	5	
	Total	60	14.4%
Printronix	P 300	14	
	P 600	2	
	Total	16	3.8%
Centronix	779	1	
	704	1	
	353	1	
	"Not specified"	1	
	Total	5	1.2%
Wang	Matrix	5	
	Daisywheel	3	
	Other	2	
	Total	10	2.4%

SIMONS

Printers (Cont'd.)

Manufacturer	Model	Occurrence	% of Total
NCR	6440	5	
	6420	1	
	Total	6	1.5%
Mannesmann	T 1802	4	
	MT 440-2	1	
	Total	5	1.2%
Okidata	93	6	
	92	5	
	83A	1	
	"Not specified"	1	
	Total	13	3.1%
Data Prod.	2260	4	
	300 LPM	3	
	B60-22	1	
	2290	1	
	"Not specified"	2	
	Total	11	2.7%
Sperry	0798	4	
	0770	4	
	0776	3	
	0791	1	
	Total	12	2.9%
TI	820 KSR	1	
	855	1	
	700	1	
	Total	3	0.7%
NEC	8023A	1	
	SP WR 7710	1	
	Total	2	0.5%
SSI	B900	1	0.2%

Printers (Cont'd.)

Manufacturer	Model	Occurrence	% of Total
Decision-D	5251-12	1	0.2%
Microline	U83	2	0.5%
Tektronix	Ink Jet	1	0.2%
Radio Shack	-	1	0.2%
Transtar	315	1	0.2%
Access MTX	-	1	0.2%
Qume	11/40	2	0.5%
CITO	C/600	1	0.2%
Data General	-	1	0.2%
Memorex	2087	2	0.5%
Four Phase	-	1	0.2%
Brother	HR-15	1	0.2%
Apple	-	1	0.2%
Various	-	11	2.9%
Total Number of Printers		**417**	**100.0%**

Number of organizations having a printer	93 (80.9% of total organizations using a computer)
Of them: mining and exploration	46 (82.1% of total mining group organizations using a computer)

SIMONS

Plotters

Manufacturer	Model	Occurrence	% of Total
HP	7475	6	
	7475A	6	
	7585B	6	
	7580A	3	
	7980	2	
	9872A	2	
	7220A	2	
	9872/7475	1	
	7225	1	
	7221	1	
	4631	1	
	"Not specified"	3	
	Total	34	36.2%
Calcomp	960	8	
	1039	3	
	1037-40	2	
	1077	2	
	970	2	
	1051 Drum-P	2	
	Flatbed/74	2	
	81	1	
	1052	1	
	907-1039	1	
	737	1	
	1073	1	
	"Not specified"	1	
	Total	28	29.8%
Houston Instr.	DMP-42	3	
	DMP-41	1	
	DMP-7	1	
	CPS 15	1	
	Total	6	6.4%
Zeta	3653	2	
	3620	1	
	3650	1	
	Zeta 100	1	
	Total	5	5.3%

Plotters (Cont'd.)

Manufacturer	Model	Occurrence	% of Total
Tektronix	4663	4	
	4662	1	
	Total	5	5.3%
Benson Var.	E/Static	1	
	5342	1	
	Statos 22	1	
	"Not specified"	1	
	Total	5	5.3%
Nicolet	1556	3	3.2%
Wild	TA-1	3	3.2%
Versatec		1	0.9%
Various	-	1	4.3%
Total Number of Plotters		**94**	**100.0%**

Number of organizations having a plotter	59 (51.3% of total organizationss using a computer)
Of them: mining and exploration	24 (42.9% of total mining group organizations using a computer)

SIMONS

CRT's and Graphics Work Stations

Manufacturer	Model	Occurrence Total	Occurrence Mining & Exploration	% of Total Total	% of Total Mining & Exploration
IBM	3278	36	-		
	5291	32	26		
	5251	30	27		
	5251-11	29	24		
	3178	16	-		
	3270	6	6		
	5256	3	3		
	3276	1	-		
	CL-Graphic	1	1		
	PC-Display	1	1		
	5251-12	1	-		
	Not specified	99	-		
	Total	255	88	21.4%	19.0%
HP	2626A	22	22		
	2624B	19	19		
	2622/24	12	12		
	26XX	10	-		
	2622A	6	5		
	2623A	6	2		
	2627A	5	1		
	2645A	4	3		
	2621A	2	2		
	2623A	2	2		
	2382A	2	2		
	72913A	1	1		
	9876	1	-		
	9816	1	-		
	80	1	1		
	Built-in Graphics	1	1		
	Total	96	75	8.1%	16.2%

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CRT's and Graphics Work Stations (Cont'd.)

Manufacturer	Model	Occurrence Total	Occurrence Mining & Exploration	% of Total Total	% of Total Mining & Exploration
DEC	VT 100	181	39		
	LA 120	36	1		
	VT 101	20	-		
	VT 100/131	14	-		
	VT 100/103	14	-		
	VT 102	3	-		
	VT 220	3	-		
	VT 240	1	-		
	VT 241	1	-		
	LA 100	1	-		
	LA 240	1	-		
	VT 640	1	-		
	VT 1XX	1	-		
	LK 201	1	-		
	Total	278	42	23.3%	9.1%
Tektronix	4014-1	9	2		
	4012	5	-		
	4114	4	-		
	4027	3	-		
	4054	3	3		
	4105	3	2		
	4010	2	1		
	4014/5	1	-		
	4006-1	1	-		
	4109/Color	1	-		
	"Not specified"	1	-		
	Total	33	9	2.8%	1.9%
Sperry	UTS 20/20W	52	52		
	UTS 20W	29	29		
	UTS 400	22	-		
	UTS 60	5	-		
	Total	108	81	9.1%	17.5%

SIMONS

CRT's and Graphics Work Stations (Cont'd.)

Manufacturer	Model	Occurrence Total	Occurrence Mining & Exploration	% of Total Total	% of Total Mining & Exploration
Honeywell	VIP 7814	50	50		
	VIP 7200S	12	-		
	VIP 7803	7	7		
	VIP 7813	5	5		
	Total	74	62	6.2%	13.4%
Wang	PC-003	10	-		
	2866-S	4	-		
	PC-005	2	-		
	"Not specified"	40	-		
	Total	56	-	4.7%	-
Cybernex	XL-84	24	-		
	XL-84/87D	6	-		
	LX-87/87D	6	-		
	6053	4	-		
	Total	40	-	3.5%	-
Volk-Craig	VC 404/414	24	-		
	VC 404	2	-		
	Total	26	-	2.3%	-
Lanpar	XT-100	60	60		
	Vision 2000	3	3		
	Total	63	63	5.4%	13.5%
Telex	3270	40	-	3.4%	-
ITT	2780	25	-	2.1%	-
NCR	7900	16	16		
	7901	14	14		
	Total	30	30	2.5%	6.4%
Hazeltine	1420-1500	7	1	0.6%	0.2%

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CRT's and Graphics Work Stations (Cont'd.)

Manufacturer	Model	Occurrence Total	Occurrence Mining & Exploration	% of Total Total	% of Total Mining & Exploration
Zenith	13 IN	5	-	0.4%	-
Data General	"Not specified"	4	-	0.3%	-
TI	911	4	4		
	PC	1	1		
	Total	5	5	0.4%	1.1%
Vucom	400	4	-	0.3%	-
Decision/D	3791	4	4	0.3%	0.8%
Viscom	2000	4	-	0.3%	-
Direct	800B/831	6	-	0.5%	-
Visual	550	2	-		
	500	1	-		
	Total	3	-	0.25%	
Allen Brady	-	3	-	0.25%	-
Synercom	AWS II	3	-	0.25%	-
Direct	831	3	-	0.25%	-
Memorex	7078	3	-	0.25%	-
HDS	Concert	3	-	0.25%	-
Anderson	AI 510	2	-	0.2%	-
Qume	QNT 103	2	2	0.2%	0.4%

CRT's and Graphics Work Stations (Cont'd.)

Manufacturer	Model	Occurrence Total	Occurrence Mining & Exploration	% of Total Total	% of Total Mining & Exploration
Apple	Graph Table	1	-	0.1%	-
USI	P13	1	-	0.1%	-
Ramtek	6211	1	1	0.1%	0.2%
Evan/ Southland	-	1	1	0.1%	0.2%
ISC	8001G	1	-	0.1%	-
Various	-	4	-	0.3%	-
Total CRT's and Graphics Work Stations		**1,194**	**464**	**100.0%**	**100.0%**

Mining and exploration organizations report ownership of 38.9% of the total amount of CRT's and graphics stations.

Number of organizations having CRT's and graphic stations	78 (67.8% of total organizations using a computer)
Of them: mining and exploration	35 (62.5% of total mining group organizations using a computer)

Digitizers

Of the total number of all surveyed organizations (198), 39 (19.7%) reported having a digitizer. Of the total number of mining and exploration organizations, 20 reported having a digitizer (28.0% of total mining and exploration organizations).

Manufacturer	Model	Occurrence Total	Occurrence Mining & Exploration	% of Total Total	% of Total Mining & Exploration
Calcomp	9000	4	3		
	800	4	-		
	9648	1	-		
	9448	1	-		
	9024	1	-		
	960	1	-		
	9240	1	-		
	9480	1	-		
	"Not specified"	10	8		
	Total	24	13	33.8%	36.1%
Summagraphics	Bitpadone	1	1		
	MMI	1	-		
	"Not specified"	11	11		
	Total	14	12	19.8%	33.3%
HP	9874A	1	-		
	9111A	1	-		
	"Not specified"	2	2		
	Total	4	2	5.7%	5.6%
Houston Instr.	HI 7048	3	3		
	Comp 7048	1	-		
	Total	4	3	5.7%	8.3%
Talos	6000	1	1		
	"Not specified"	2	1		
	Total	3	2	4.2%	5.5%
Cybernex	D 1610	4	-	5.6%	-
Numeric	"Not specified"	4	-	5.6%	-

Digitizers (Cont'd.)

Manufacturer	Model	Occurrence Total	Occurrence Mining & Exploration	% of Total Total	% of Total Mining & Exploration
GTCO	Digitizer A0	3	-	4.2%	-
Wild	BC TA2, A1D	3	-	4.2%	-
Tektronix	4663	1	1		
	4954	1	-		
	Total	2	1	2.8%	2.8%
NCB	Minds Key B	1	1	1.4%	2.8%
TEC	F10-40	1	1	1.4%	2.8%
Ruscom	"Not specified"	1	-	1.4%	-
Evans Southland	"Not specified"	1	1	1.4%	2.8%
Summer/ GRP	"Not specified"	1	-	1.4%	-
Hi-State	Pre-Coord	1	-	1.4%	-
Total Number of Digitizers		**71**	**36**	**100.0%**	**100.0%**

Number of organizations having a digitizer 39 (33.9% of total organizations using a computer)

Of them: mining and exploration 20 (35.7% of total mining group organizations using a computer)

Tape Drives

The number of organizations reporting the use of tape drives was 50 (25.3%). There were 20 (40% of those with tape drives) mining and exploration organizations (27.7% of them) with tape drives.

Manufacturer	Model	Occurrence	% of Total
DEC	TE16	7	
	TS11	3	
	TU58	2	
	TU16	2	
	TU78	2	
	TU77	2	
	TU80	1	
	"Not specified"	3	
	Total	22	18.8%
HP	7970E	8	
	7978A	2	
	7911	2	
	7976	2	
	9845B	2	
	7970	1	
	CTD 7912	1	
	"Not specified"	4	
	Total	22	18.8%
Sperry	434	17	
	436	6	
	Total	23	19.7%
IBM	3420	4	
	3420-8	3	
	3420-7	3	
	8809	1	
	"Not specified"	1	
	Total	12	10.3%
Honeywell	MTP 8001	4	
	"Not specified"	3	
	Total	7	6.0%

Tape Drives (Cont'd.)

Manufacturer	Model	Occurrence	% of Total
Kennedy	9100	4	
	"Not specified"	8	
	Total	12	10.3%
Univac	U36	5	4.3%
Cipher	"Not specified"	2	1.7%
Data General	6021	1	
	"Not specified"	1	
	Total	2	1.7%
Memorex	3266	2	
	"Not specified"	2	
	Total	4	3.4%
ITT Courie	2700	2	1.7%
NCR	635	2	1.7%
Wang	2209V	1	0.8%
Allen Bradley	Tape loader	1	0.8%
Total Number of Tape Drives		117	100.0%

Specialized Peripherals

Manufacturer	Name/Model	Quantity
Diskette Drive		
DEC	RX02	1
HP	9895A	1
	7920 (50 MB)	1
	7900 E (5 MB)	1
	7914	2
	7905	1
NCR	6530	8
Graphics		
IBM	Graph. Station	1
DEC	Graph VS/11-FS	1
	FPA FP 570	1
	Table VS 100X	1
Intergraph	Rasters	6
	GMA	4
Apple	Table	1
Wild	Stereo Plotter A8	1
	Stereo Plotter B8	1
	Stereo Plotter B8S	1
Miscellaneous		
Geodat	Geodat	1
IBM	PC	7
Houston Instr.	DMP-41	1
Radio Telemetry	Slope Monitoring System	1

HARDWARE PURCHASE INTENTION

Findings on the hardware purchase intentions were limited by the number of responses to the Hardware section of the questionnaire (58.1%) complete. Only 4 of the organizations of those reporting not having a computer, indicated that they would like to purchase one in the near future.

Computers

Of the total of 198 organizations, 52 (26.3%) indicated that they intend to add to or expand their existing system. 35 of them were mining and exploration organizations.

A total of 32 participants, or 61.5% of the responses indicated purchase intentions of micro computers. Only 11.8% of organizations intends to buy a mainframe computer.

Overall, the organizations indicated that they will buy 210 computers, most of them (182) within the next 12 months. The distribution of computers by the size is: 84.7% microcomputers, 10.5% mini computers and 4.8% mainframe computers. The preferred manufacturers are IBM, DEC and HP and, generally speaking, organizations prefer to stay with the make they already have.

Peripherals

Approximately 10% of organizations indicated purchase of additional peripherals. Most of them seem to like to obtain or to increase graphic capabilities of their computers and intend to buy graphic stations and plotters. A number of organizations want to increase the memory storage capacity.

Most of the purchases of peripherals are to be realized within one year.

Generally

From the comments on returned questionnaires, the investigated organizations have a reasonably good attitude towards the computer hardware usage. The purchase intentions are mostly based on the actual experience with the computer hardware and any expansions or additions to the systems are planned very cautiously. Most of the organizations plan their future purchases on evaluation of the actual requirements basing them on the possibility of actual economic applications of the particular software.

The situation in the mining and exploration group is a little bit more grim, reflecting the present depression in the mining industry. Mining and exploration organizations seem to go the way of smaller and more independent equipment.

HARDWARE PURCHASE INTENTION

Computers

Of the total of 198 organizations, 52 (26.3%) indicated that they intend to buy a computer. 35 (67.3%) of these were mining and exploration organizations. Only 4 organizations (all mining) of those that reported not having a computer, indicated an intention to purchase one.

	Computer	No. of Organizations Intending to Purchase		% of Total	
		Total	Mining & Exploration	Total	Mining & Exploration
Type	Mainframe	8	7	11.8%	14.6%
	Mini	20	13	29.4%	27.1%
	Micro	40	28	58.8%	58.3%
System	Mainframe	3	3	5.8%	10.0%
	Mini	9	6	17.3%	20.0%
	Micro	28	16	53.8%	53.3%
	Mainframe + Mini	-	-	-	-
	Mainframe + Micro	-	-	-	-
	Mini + Micro	8	2	15.4%	6.7%
	Mainframe + Mini + Micro	4	3	7.7%	10.0%

When		Quantity to be Purchased by Period (months)			
		<6	7 - 12	>12	N/A
	Mainframe	4	4	1	1
	Mini	4	7	8	3
	Micro	80	83	10	5

HARDWARE PURCHASE INTENTION (Cont'd.)

Peripherals

	No. of Organizations Intending to Purchase		No. of Units to be Purchased		Quantity to be Purchased by Period (Months)			
Peripherals	Total	% of Total No. of Responses	Replacement	Total*	<6	7 - 12	>12	N/A
Plotters	24	12.1%	2	47	8	15	22	2
Digitizers	11	5.6%	-	11	5	4	1	1
Graphic Stations	23	11.6%	-	74	10	6	56	2
Terminals	26	13.1%	2	192	77	74	39	2
Memory Storage Capacity	27	13.6%	1	29	13	14	1	1
Other	9	4.5%	-	9	3	2	2	2

* Replacements included.

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SOFTWARE RESEARCH AND DEVELOPMENT

The participants in the investigation questionnaire and/or interviews reported a total of 95 computer programs on a research and development phase, 8.7% of the total 1,093 programs identified by the investigation. Of the total of 95 modules categorized on research and development, 71 or 75% are currently on development, and 24 or 25% were reported as wanted.

Appendix 2 shows a tabulation of software modules in research and development sorted by activity or functions and indicating program names, abstracts and areas of application (surface or underground mining, hard or soft rock).

The distribution by category of the software modules currently on research and development is shown in the following table.

	Number of Modules & Percentage					
Category	Current R & D	%	Wanted R & D	%	Total R & D	%
Exploration, mine design and development	34	47.9%	7	29.2%	41	43.2%
Mine production	22	31.0%	9	37.4%	31	32.6%
Safety and environment	1	1.4%	4	16.7%	5	5.3%
Auxiliary processes	14	19.7%	4	16.7%	18	18.9%
Total	71	100.0%	24	100.0%	95	100.0%

The modules in research and development phase were categorized by type of mining as follows:

Type of Mining	Number of Modules
Underground mining - hard rock	38
Underground mining - soft rock	10
Surface mining - hard rock	49
Surface mining - soft rock	59

Several software modules are applicable to both suface and underground mining, or to both hard and soft rock producing a total of 156 modules or program applications.

The distribution of modules or programs by activities is shown below:

Category 1: Exploration, Mine Design and Development

Activity No.	Description	Number of Modules Current R & D	Wanted R & D	Total R & D
11	Data management	3	1	4
12	Reconnaissance exploration	3	-	3
13	Target investigation	4	-	4
14	Orebody modelling	3	1	4
15	Graphics	5	1	6
16	Statistics	3	-	3
17	Geostatistics	4	-	4
18	Ore reserves	4	1	5
19	Mine planning and design	2	1	3
20	Mine evaluation	2	1	3
21	Ultimate pit analysis	1	1	2
	Total Category 1	34	7	41

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Category 2: Mine Production

Activity No.	Description	Number of Modules Current R & D	Wanted R & D	Total R & D
23	Drilling, breaking, cutting	3	1	4
24	Material loading	4	1	5
25	Material transport	3	1	4
26	Material crushing	-	1	1
27	Mining simulation	5	1	6
28	Production scheduling	4	1	5
29	Production recording	1	1	2
30	Production reporting	-	1	1
31	Other (monitoring/reclamation)	2	1	3
	Total Category 2	22	9	31

Category 3: Safety and Environment

Activity No.	Description	Number of Modules Current R & D	Wanted R & D	Total R & D
32	Face support	-	1	1
33	Roadway support	-	1	1
34	Ventilation	-	1	1
35	Monitoring	1	1	2
	Total Category 3	1	4	5

Category 4: Auxiliary Processes

Activity No.	Description	Number of Modules Current R & D	Wanted R & D	Total R & D
37	Data management	1	-	1
38	Engineering calculations	1	1	2
39	Economic & financial analysis	6	1	7
40	Soil & rock mechanics	4	1	5
41	Communications	-	-	-
42	Human resources	-	-	-
43	Equipment maintenance	2	1	3
	Total Category 4	14	4	18

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RESEARCH ON COMMERCIAL SOFTWARE

General

It should be noted that the research was completed before the answers to the questionnaire had been received, and that there may therefore be some duplication in the software reported on in the two sections.

The research on computer software available on the international commercial market was based on software directories, online databases such as Dialog, specialized magazines, vendors' brochures and conference proceedings (see List of Sources). In some cases considerable time was spent in extracting the pertinent details from the available information.

The organizations whose computer software was listed in the research were classified using a breakdown similar to that used with participants in the investigation questionnaire.

A total of 120 organizations were included in the research of commercial software, several of these also having responded to the questionnaire. Separate database files were created for responses to the questionnaire and for the information compiled for the research.

General categorization of software marketing organizations:

Organization Type	Number	%
Mining and exploration	8	6.7
Software vendor	30	25.0
University	14	11.7
Government departments, federal and provincial/state	10	8.3
Consultant	55	45.8
Other	3	2.5
Total	120	100.0

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In several cases the documentation available did not permit a clear distinction to be made between software vendors and consultants.

Categorization of computer software available on the international market: a total of 300 software modules available in the international market were perused for categorization. A list of these modules arranged by activities (1 to 40, see questionnaire form for codes) is shown in Appendix 3A, giving modules and vendors names, and areas of application. Appendix 3B shows abstracts of the modules.

Detailed marketing options were not analyzed. For the purpose of file completion, it was assumed that all modules found in the research are available for purchase and/or lease option. These modules were classified in four major categories as follows:

Category	Total Number of Modules	%
Exploration, mine design and development	131	43.7
Mine production	53	17.7
Safety and environment	37	12.2
Auxiliary processes	74	24.7
Not specified	5	1.7
Total	300	100.0

Figure No. 27 shows a frequency bar chart with this distribution.

The software modules were classified also according to the "Area of Application: Underground and Surface Mining, Hard or Soft Rock". Figure No. 27A shows the distribution by Area of Application. The highest frequency of application of the researched modules is for surface soft rock mining 34% of a total of 656 modules. The total here is produced by adding the applications in all 5 areas: underground and surface mining, hard and soft rock, and not specified. Several modules have more than one application.

Exploration, Mine Design and Development

The distribution of software modules in this category is shown in Figure No. 28 and in Table VIII. Mine design and data management functions comprise approximately 61% of the total (35% and 26% respectively). The number of modules applicable to surface mining (158) is approximately 70% greater than the software applicable to underground (93).

Mine Production

The mine production category distribution is shown in Figure No. 29 and in Table IX. The majority (51%) of the software modules in this category are classifiable as the mining simulation function or group, including simulations of draglines, truck dispatch systems, underground coal operations, etc. The second group in number is material transport with 17%. The number of modules applicable to soft rock mining (surface and underground) is 67% greater than the number applicable to hard rock mining.

Safety and Environment

The distribution of modules in this category is shown in Figure No. 30 and in Table X. The total number of computer programs in this group is 37, or 12.3% of the total, more than double the proportion of modules in this category reported as used or needed in the survey questionnaire. Environmental monitoring and face support (hydraulic props, slope control) functions total respectively 14 (38%) and 9 (24%). The programs applicable to soft rock mining (coal, potash, etc.) in underground and surface are respectively 36% and 25% of the total of this category. The modules applicable to hard rock mining are respectively 20% and 19%.

Auxiliary Processes

The majority of the software in this category is for economic and financial analysis with a total of 37 or 50%. Data management and engineering calculations account for 13.5% each. The distribution in this group is shown in Figure No. 31 and in Table XI.

Responses to Questionnaire

The responses to the investigation questionnaire reported a total of 223 programs or software modules available in the international market with options for purchase, lease, timeshare or service bureau. This total represents 20% of the total 1,093 modules identified in the investigation. The rest of the programs or modules did not specify marketing options or are not available in the market at all.

The modules with marketing options are distributed by type of mining as follows:

Type of Mining	No. of Modules
Underground mining - hard rock	140
Underground mining - soft rock	138
Surface mining - hard rock	152
Surface mining - soft rock	172

Several software modules are applicable to both surface and underground mining, or to both hard and soft rock, producing a total of 602 applications.

The distribution by marketing options of the software reported available in the market is as follows:

Type of Marketing Option	No. of Modules
Option to purchase	164
Option to lease	151
Option to timeshare	66
Option to service bureau	109

Several computer programs or software modules are available for more than one option. The total number of marketing options available is 490.

Appendix 3C shows a list of software modules indicating module names, areas of application and marketing options. Appendix 3D shows abstracts of module descriptions and names of the organization reporting software programs with one or more marketing options.

The majority of the computer programs in this category were also identified in the research on commercial software.

Compatibility With Canadian Mining Conditions

In general the computer programs available on the market are compatible with Canadian mining conditions. The compatibility is higher for hard rock mining, surface and underground. Commercial programs or modules for coal mining are also compatible with the Canadian operations on the prairies and in the Nova Scotia coal deposits. These programs, with the exception of those based on cross-sectional modelling, are not applicable to the structurally deformed coal deposits of the foothills and Rocky Mountain regions.

The research on commercial programs did not identify specific modules applicable to the modelling of oil sand deposits.

Several commercial programs for conventional underground coal mining were identified, mainly for modelling and scheduling of room and pillar type of operations. Currently this type of mining is not very active in Canada.

The research identified several program packages applicable to complete evaluation of small coal deposits, including geological modelling, reserve calculations, mine simulation, equipment sizing, production scheduling and financial analysis. These types of programs do not offer sufficient capacity or design sophistication as needed in Canadian coal mining conditions, where coal developments are limited to a minimum size determined by infrastructure and overland transportation costs, and for the long term type of sales contracts (utilities, export).

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TRENDS & AREAS OF INTEREST FOR DEVELOPMENT

The respondents to the questionnaire and the organizations interviewed indicated a need for software in the four categories given in the questionnaire, namely:

- Exploration, mine design and development;
- Mine production;
- Safety and environment;
- Auxiliary processes.

There was a large demand for programs in the area of mine production, and in the areas of exploration, mine design and development.

A breakdown by category and activity of software desired by the organizations is given in Tables III to VI.

Some general descriptions of systems recently developed and some general descriptions of software systems desired by the participants are given in the following paragraphs. In addition some general trends and observations on software development are given.

Long and Short Term Mine Planning

There is a strong industry demand for short term mine planning. Mine operators in particular want very specific solutions. There are also needs for mine design software linked with mine optimization software. In particular, there is an industry need for multiple coal seam modelling and mine planning and optimization software.

Long and Short Term Mine Planning (Cont'd.)

Some firms have limited underground mine planning, mainly the plotting of drill holes, cross-sections, etc. There is interest in developing comprehensive underground orebody modelling.

Integrated Mine Scheduling - Process Simulation Software

A mine planning software system that can integrate mine scheduling with mineral processing is desired by mine operators and engineering firms for short and long range mine planning.

Dragline Simulation Software

There is a demand for development of a three-dimensional dragline simulation program that can help in solving selective material handling (soil salvaging and reclamation) and engineering of critical pit areas such as ramps, pit ends and changes of type of overburden (geotechnical analysis).

Open Pit Mine Design

A comprehensive open pit mine design system has been developed by a Canadian university on a mainframe computer with a graphics workstation. They use Precision Visuals DI-3000 plot software and a Tektronics 4109 color graphics terminal (19" screen). The system took more than 5 man years to develop, and was developed in cooperation with a mining company. Some proposed additions are the use of the floating cone method or a linear programming (LP) technique for production scheduling.

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Truck and Shovel Scheduling and Dispatch System

There is a need for truck and shovel scheduling and dispatch systems.

A sophisticated truck and shovel scheduling and dispatch system has been developed by a Canadian university. The dispatching and simulation part of the system has also been set up on a PDP 11/34 for a mining company. The scheduling portion of the system is also going to be installed on the PDP 11/34. The PDP 11/34 has an Intecolor Colour Graphics terminal for simple graphics of the operation. There are plans to add a microprocessor with graphics capabilities to improve the illustration and graphical displays.

The system consists of: a Network Optimization module for short term mining plan, volume by shovel and truck assignments; a Real Time Dispatching module for minimal deviation from framework taking into account the nearest 5-10 next available trucks. Some features of the Network Optimization are that it takes into account travel times, and an estimated waiting time at the shovel - a function of the number of trucks, as well as convex spacial constraints. One desirable feature of the network model is that the system is stable and continuous when the ore and waste constraints are changed. The second module is set up so that it can be used as a planning tool by the engineer to test network solutions and simulate or change assignments. It can also be used as an operator's terminal for real time dispatching. The dispatching module is currently being tested.

Truck/Shovel Simulation

A software vendor has developed a truck/shovel travel simulation program for a mining company. The system handles multi-pit, multi-dump operation.

Open Pit Haulage System

A simulation model for an open pit haulage system has been developed by a Canadian university. The package is a simulation model of open pit haulage systems using trucks and shovels and is designed to minimize the haulage costs. Some features of this system are:

- Fixed time increments;
- Interactive simulation;
- Unlimited simulation capabilities;
- Fast, flexible and efficient.

Some recent enhancements to this model are a linear programming dispatching algorithm.

Orebody Modelling

There is a demand for very general graphical modelling of deposits. Such a system has to be able to handle complex geology, such as steep dips, overturned structures, etc.

A comprehensive orebody modelling system, with three-dimensional interactive graphics, is of interest to many firms. As smaller problems get put on micros, the need for more comprehensive modelling systems will require the use of larger computers, super minis or mainframes, with intelligent graphic workstations attached.

Another requirement is a need for underground mine orebody modelling, for example, modelling of amorphous sulphite deposits.

Underground Geological Modelling

One firm felt that there appeared to be little underground mining software and in particular very little interpretative geology software. They want a system with good interactive graphics capabilities. The exploration group would like to be able to do three-dimensional models of deposits. They would like to manipulate and revise three-dimensional models and view them interactively on colour graphics terminals (e.g. different colours for different geological units). They want to be able to handle surfaces and faults. They would like to be able to work back and forth between section and plan views and also surface views, and finally three-dimensional model and perspective views.

Another desire would be to incorporate mining into the model, so that mined material is deleted from the inventory as it is completed each month. A main requirement is that the system be user friendly, so that the geologist, etc. can use it, not just computer people.

Underground Mining

There is a demand for underground mining applications, mainly in hard rock, but also for coal and potash, e.g. an underground stope scheduling system.

Underground Ramp Design

One mining company has recently developed a ramp design system, on an IBM PC-XT connected to a Sumigraphics MM1 digitizer, an HP 7475 plotter and an HP InkJet printer, and a colour monitor. The system just completed (their first interactive graphics system on a micro) is a Ramp Design System for an underground Mine Model. The objective is to design underground ramps, avoiding bad geology, faults, previous development, top of orebodies, etc. The main feature is interactive graphical display and editing while designing ramps. Section, plan and isometric views of the region of interest are available. Messages are given at the top of the screen when displaying graphics and menus provide processing options and parameter input. The system is written in Fortran with some screen and peripheral interfacing written in Assembler.

Numerical Modelling on Large Systems

There is a demand for development in the area of numerical modelling, particularly for underground rock stability. For example three-dimensional numerical modelling in the area of Rock Mechanics, with emphasis on ground conditions, for the study of rock failure, particularly rock failure prediction. For example, a mining company recently purchased a VAX 11/750, with 4 megabytes of memory, large disk capacity, an attached array processor, and an Adage 3010 graphics processor. They would like and need a more powerful processor to be able to do real time rotations and more detailed three-dimensional modelling.

Geotechnical and Numerical Modelling

Some geotechnical and numerical modelling work is being done, both at Canadian universities and mining companies.

Micros For Front End Applications or Small Problems

There is a definite interest in using a micro-computer for data entry and small database applications, which can then update a main database on a central computer system. For example, a database system has been developed by a vendor for an oil well storage system that runs on a VAX computer and can be accessed and updated by an IBM PC, including plotter output at the main center.

Another system that has been developed by them is for geochemical data entry, processing and plotting. The complete system runs on a VAX computer and a smaller version, mainly for data entry and simple processing (no plotting), runs on several micros. The micros have printer plots and data can be transferred to the VAX for true graphics. The system can be used from field notes to final product.

Small Systems at Minesites

There is interest in having small systems that can be used by site personnel at small mines (e.g. <4,000 tpd). For example, the CANMET MRL open stope blasting pattern program running on a micro-computer and have onsite personnel use it.

Interactive Programs and Graphics

Some systems developed at a Canadian university are a mine ventilation system and an underground mine development plotting system. This system is currently a batch system, but they are looking at making an interactive version of this program. They are looking at adapting the system to smaller computers, e.g. to a large IBM PC-XT or AT.

Applications on Micros For Teaching Purposes

A university in eastern Canada is interested in modifying a dynamic programming-based open pit mine design and evaluation system that is used by students to determine the rate of production and the cutoff grade. They plan to put this system onto an IBM PC-AT for use in the classroom for teaching purposes.

Databases

One exploration group has been entering geochemical data into a database, but as yet have not really used the database.

There is an interest in databases on micros. For example, a detailed database on rock mechanical instrumentation has been implemented by a mine operator on an HP 9816 micro-computer.

Computerized Surveying Systems

Computerized survey systems for underground mines have been implemented by several major mining companies on a micro-computer. Micro-computers are also being used for survey and small engineering calculations at numerous minesites.

Central Computer With Online Micros

One firm has decided to change the direction of their work from a central batch oriented view towards a central database with wide interactive access throughout the divisions, from both terminals and micros. They would add more terminals and micros and have direct access for supplies, inventory, purchasing, etc. They would also develop online, real time systems for production control to be used by the mining and smelting division on a shift basis.

High Level Databased Languages

Some firms are looking at high level languages/systems such as Focus, Ramis, or other database query languages, to implement an information center. This would give direct computer access to the users, with processing being user driven. It would provide uploading and downloading of data and programs for micros to and from the mainframe. Micros could also be used directly as dumb terminals or for local processing. The psychology is to at least give the user a sense of more control over his computer and processing needs. Specific information of concern division-wise would be put onto the main computer database. The decision as to what is division-wide information is done by the person in charge of a group.

Engineering Drawings on Micros

Micros at some minesites are probably performing about 10 - 15% of the workload, mainly surveying systems and production scheduling. There is an interest in implementing CADD systems based on micros.

Engineering Drawings on Micros (Cont'd.)

One minesite has installed an HP 1000 model A900 computer with an HP 7580 plotter and a Calcomp digitizer, mainly for drafting. This system uses the CAEDAS CAD software package. There are plans to put up some short range mine scheduling on this system.

Another minesite is implementing a CAD system based on an IBM PC, using the Auto-CAD software, with a B & L DMP 41 plotter, an external hard disk, an 8087 co-processor and high resolution graphics. They expect that this system will do about 95% of their drafting requirements.

Micros as Links to Mainframe

There is interest in using the mainframe computer for ore reserves, but downloading selected data to a micro and working on it there. Also to tie in survey data directly onto mine layouts.

Small Computers With Good Graphics

There are firms committed to an emphasis on small computers and modern graphics. All their software is graphics oriented and useable by the geologist or mining engineer, the average user. Programs are for a single system and optimized for that system.

User Groups

At some locations users have formed a user's group within the firm. Such a group can have valuable input into corporate standards and strategy.

Downloading Systems to Micros

Some vendors are downloading as much software as possible to micro-computers. The large computers will then mainly be required to tackle larger problems such as large orebody models and three-dimensional numerical models.

Several large firms have now put the emphasis on micros and most new development work is for micros.

Other Trends and Areas of Interest

Some other trends are for more graphics, particularly for orebody modelling and mine design, and for real time production control.

There is also a demand for computer software that has an easy user interactive interface and that can be used by site personnel without a lot of training.

Another item of interest is a system for storing and interactively viewing digitized geological data. Then to be able to call up and view borehole data on sections, view surfaces, view borehole assay data, geochemical data and geophysical data.

There is also interest in improving geostatistical analysis of deposits. In particular for better modelling of precious metal deposits (because of the nugget effect).

Interest was shown in the use of micro-processors to monitor and adjust the torque and pressure for drilling, particularly for raise boring.

Other Trends and Areas of Interest (Cont'd.)

Also of interest was optimizing drilling and blasting, e.g. monitoring rate of drilling and tailoring blasts to the conditions. Apparently some work has been done in this area in Sweden.

Other areas of R and D are in drilling and blasting patterns.

Another area of interest is in field data logging using hand-held key units and direct input into micros or other computers. For example, a downhole geophysical logging system for coal.

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TABLE I: BREAKDOWN OF COMPUTER PERSONNEL

Average number of staff per participant

() = Number of responses.

Function	Management	System Analysts	Programmers	Operators	Other
Data entry	1.4 (20)	1.0 (5)	1.0 (4)	4.3 (37)	4.2 (13)
Data processing	1.7 (31)	3.0 (16)	4.0 (24)	2.5 (25)	9.2 (15)
Technical applications	1.9 (49)	5.5 (41)	4.9 (61)	1.2 (41)	6.0 (13)
Systems/operations	4.5 (33)	2.0 (27)	2.7 (21)	2.3 (29)	9.2 (16)

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TABLE II: DISTRIBUTION OF COMPUTER PERSONNEL BY TRAINING

Average staff per participant:

() = Number of responses.
P = Present personnel.
F = Future addition.

Function	In House		Course Work		Cert./Dipl.		Degree	
	P	F	P	F	P	F	P	F
Data entry	3.8 (21)	3 (9)	1.4 (7)	0.3 (3)	1.7 (7)	0.7 (3)	1 (3)	2 (3)
Data processing	4.2 (12)	1.9 (7)	1.7 (7)	1.4 (5)	1.7 (9)	- (-)	2.2 (14)	1.5 (2)
Technical applications	2.7 (13)	4.9 (8)	1.6 (12)	2.9 (12)	2.8 (14)	1.6 (7)	4.3 (32)	4.1 (12)
Systems/ operations	2.2 (14)	4.0 (8)	1.3 (7)	0.7 (4)	2.6 (5)	1.0 (1)	2.5 (16)	3 (5)

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QUESTIONNAIRE SOFTWARE MODULES CATEGORIZATION

TABLE III

CATEGORY 1 - EXPLORATION, MINE DESIGN AND DEVELOPMENT

Function	Total	Have	Need	Number of Modules: U/G Mine Hard Rock	U/G Mine Soft Rock	Surf.Mine Hard Rock	Surf.Mine Soft Rock	Not Spec'd.	Organization Developed: Yes	No	*	Development Completion Status: RED	Test	Limited	Full	*
Data management	66	58	8	35	28	31	38	9	28	22	16	4	3	6	26	27
Reconnaissance exploration	50	45	5	24	15	33	29	4	23	12	15	3	4	5	23	15
Target investigation	32	27	5	15	6	22	16	2	16	6	10	4	4	3	12	9
Orebody modelling	46	37	9	19	11	29	25	5	16	8	22	4	2	2	16	22
Graphics	54	43	11	29	20	33	30	8	18	7	29	6	3	3	20	22
Classical statistics	33	28	5	15	10	17	15	7	12	9	12	3	2	1	11	16
Geostatistics	36	28	8	14	8	23	12	4	10	6	20	4	4	3	8	17
Ore reserves	44	35	9	16	6	25	21	4	5	3	4	5	3	4	18	14
Mine planning & design	54	40	14	26	14	29	25	5	21	12	21	3	1	5	14	31
Mine valuation	28	21	7	11	12	19	18	1	7	9	12	3	-	2	8	15
Ultimate pit analysis	24	14	10	2	2	17	12	4	8	4	12	2	-	2	7	13
Other	18	17	1	7	5	8	4	7	9	4	5	-	-	8	6	4
Total No. of Modules	485	393	92	213	137	286	245	60	187	105	193	41	26	44	169	205
Percentage of Total	100%	81%	19%	23%	15%	30%	26%	6%	39%	22%	40%	8%	5%	9%	35%	42%

* Not Specified

[illegible] SOFTWARE MODULES CHARACTERIZATION

TABLE IV

CATEGORY 2 - MINE PRODUCTION AND OPERATIONS

Function	Total	Have	Need	Number of Modules: U/G Mine Hard Rock	U/G Mine Soft Rock	Surf. Mine Hard Rock	Surf. Mine Soft Rock	Not Spec'd.	Organization Developed: Yes	No	*	Development Completion Status: R&D	Test	Limited	Full	*
Drilling, breaking and cutting	19	9	10	7	3	10	6	3	5	2	12	4	-	1	2	12
Material loading	21	12	9	9	4	7	11	3	8	4	9	5	3	1	7	5
Material transport	22	17	2	3	2	8	15	5	11	3	8	4	2	3	8	5
Material crushing	10	4	6	1	1	1	3	6	1	2	7	1	-	-	1	8
Mining simulation	37	25	12	9	7	16	19	18	17	4	16	6	4	4	8	15
Production scheduling	33	16	17	14	6	10	14	7	13	3	17	5	1	2	9	16
Production recording	25	17	8	7	3	9	10	4	14	3	8	2	-	1	11	11
Production reporting	19	20	7	6	2	9	5	4	6	3	10	1	-	-	6	12
Other	17	13	4	6	2	6	9	1	11	3	3	3	-	1	9	4
Total No. of Modules	203	125	78	62	30	76	92	41	86	27	90	31	10	13	61	88
Percentage of Total	100%	62%	38%	21%	10%	25%	31%	14%	42%	13%	44%	15%	5%	6%	30%	44%

* Not Specified

QUESTIONNAIRE SOFTWARE MODULES CATEGORISATION

TABLE V

CATEGORY 3 - SAFETY AND ENVIRONMENT

Function	Total	Have	Need	U/G Mine Hard Rock	Number of Modules: U/G Mine Soft Rock	Surf.Mine Hard Rock	Surf.Mine Soft Rock	Not Spec'd.	Organisation Developed: Yes	No	*	Development Completion Status: R&D	Test	Limited	Full	*
Face support (props, slope)	12	9	3	4	4	3	2	5	2	4	6	1	-	-	2	9
Roadway support	8	4	4	4	5	1	1	3	2	2	4	1	-	-	2	5
Ventilation	19	12	7	11	8	3	2	5	5	6	8	1	-	1	4	13
Environmental monitoring	14	12	2	3	3	0	6	1	9	1	4	2	-	3	6	3
Other	2	1	1	2	1	1	1	-	1	-	1	-	-	1	1	-
Total No. of Modules	55	38	17	24	21	17	12	16	19	13	23	-	5	5	15	30
Percentage of Total	100%	69%	31%	27%	23%	19%	13%	18%	35%	24%	42%	9%	-	9%	27%	55%

* Not Specified

GEOTECHNICAL SOFTWARE MODULES CATEGORIZATION

TABLE VI

CATEGORY 4 – AUXILIARY PROCESSES

Function	Total	Have	Need	Number of Modules: U/G Mine Hard Rock	U/G Mine Soft Rock	Surf.Mine Hard Rock	Surf.Mine Soft Rock	Not Spec'd.	Organization Developed: Yes	No	*	Development Completion Status: R&D	Test	Limited	Full	*
Data management	22	16	6	8	4	7	8	6	3	4	15	–	–	1	4	17
Eng. calculations (flow diagram)	34	25	9	12	8	16	14	7	14	6	14	2	–	2	11	19
Economic & financial analysis	52	41	11	25	10	29	22	6	19	8	25	7	1	5	17	22
Soil & rock mechanics	46	39	7	29	18	17	20	6	22	13	11	5	2	6	10	23
Communications	8	7	1	–	1	2	2	3	4	–	4	–	–	–	3	5
Human resources	24	19	5	8	3	7	6	6	12	4	8	–	1	3	8	12
Equipment maintenance	33	23	10	12	7	12	16	7	11	8	14	3	–	1	8	21
Other	51	46	5	16	6	17	21	11	25	13	13	–	–	3	23	25
Total No. of Modules	270	216	54	110	57	107	109	41	110	56	104	17	4	21	84	144
Percentage of Total	100%	80%	20%	26%	13%	25%	26%	10%	41%	21%	38%	6%	2%	8%	31%	53%

* Not Specified

TABLE VII

SOFTWARE MODULES BY LANGUAGE AND COMPUTER

Language	Mainframe		Mini		Micro		Unspecified		Total	
	#	%	#	%	#	%	#	%	#	%
FORTRAN	182	81	144	56	21	16	18		365	57
BASIC			58	22	61	46	5		124	19
COBOL	14	6	23	9	5	4	2		44	7
PL/I	18	8					1		19	3
RPG II			18	7					18	3
PASCAL					10	7			10	1
C			4	1	1				5	
CORAL 66					15	11			15	2
APL	1								1	
Assembler	5	2	5	2	2				12	1
Data Base & Query Languages	5	2	4	1					9	1
OTHER			2		16				18	3
	225		258		131		26		640	

Language	Mainframe	Mini	Micro	Unspecified	Total

There were 510 modules for which no language was specified. The total 640 + 510 = 1150 is 57 greater than the total number 1093 of modules. Some modules indicated more than one language and sometimes more than one computer.

TABLE VIII
RESEARCH SOFTWARE MODULES CATEGORIZATION

CATEGORY 1 - EXPLORATION, MINE DESIGN AND DEVELOPMENT

Function	Total	(%)	U/G Mine Hard Rock	U/G Mine Soft Rock	Surf.Mine Hard Rock	Surf.Mine Soft Rock	Not Specified
Data management	34	(26)	13	16	23	24	-
Reconnaisance exploration	2	(1)	1	-	2	1	-
Target investigation	3	(2)	2	1	3	1	-
Orebody modelling	10	(8)	1	5	7	10	-
Graphics	11	(8)	4	4	11	11	-
Classical statistics	1	(1)	-	-	1	1	-
Geostatistics	3	(2)	1	3	1	2	-
Ore reserves	8	(6)	2	4	7	8	-
Mine planning and design	46	(35)	16	18	28	30	-
Mine valuation	5	(4)	-	1	5	5	-
Ultimate pit analysis	7	(6)	1	-	6	6	-
Other	1	(1)	-	-	-	-	1
	131	(100)	41	52	59	99	1 (-)
			16%	21%	24%	39%	-

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TABLE IX
RESEARCH SOFTWARE MODULES CATEGORIZATION

CATEGORY 2 - MINE PRODUCTION AND OPERATIONS

Function	Total	(%)	U/G Mine Hard Rock	U/G Mine Soft Rock	Surf.Mine Hard Rock	Surf.Mine Soft Rock	Not Specified
Drilling, breaking and cutting	1	(2)	1	-	1	-	-
Material loading	4	(7)	1	2	2	2	-
Material transport	9	(17)	2	5	5	7	-
Material crushing	-	(-)	-	-	-	-	-
Mining simulation	27	(51)	4	7	11	21	-
Production scheduling	9	(17)	2	6	5	7	-
Production recording	-	(-)	-	-	-	-	-
Production reporting	1	(2)	-	1	-	-	-
Other	2	(4)	-	-	2	2	-
	53	(100)	10	21	26	39	-
			10%	22%	27%	41%	-

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TABLE X
RESEARCH SOFTWARE MODULES CATEGORIZATION

CATEGORY 3 - SAFTEFY AND ENVIRONMENT

Function	Total	(%)	U/G Mine Hard Rock	U/G Mine Soft Rock	Surf.Mine Hard Rock	Surf.Mine Soft Rock	Not Specified
Face support (props, slope)	9	(24)	1	6	3	4	-
Roadway support	1	(3)	1	1	-	-	-
Ventilation	6	(16)	4	6	1	2	-
Environmental monitoring	14	(38)	6	10	6	7	-
Other	7	(19)	3	3	4	5	-
	37	(100)	15	26	14	18	-
			20%	36%	19%	25%	-

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TABLE XI
RESEARCH SOFTWARE MODULES CATEGORIZATION

CATEGORY 4 - AUXILIARY PROCESSES

Function	Total	(%)	U/G Mine Hard Rock	U/G Mine Soft Rock	Surf.Mine Hard Rock	Surf.Mine Soft Rock	Not Specified
Data management	10	(13.5)	8	10	8	10	-
Eng. calculations (flow diagram)	10	(13.5)	3	6	4	9	-
Economic and financial analysis	37	(50.0)	17	24	22	32	-
Soil and rock mechanics	9	(12.2)	2	3	5	7	-
Communications	-	(-)	2	3	5	7	-
Human resources	2	(2.7)	2	2	2	2	-
Equipment maintenance	3	(4.0)	2	2	2	3	-
Other	3	(4.1)	1	2	1	3	-
	74	(100.0)	37	52	49	73	-
			17%	25%	23%	35%	-

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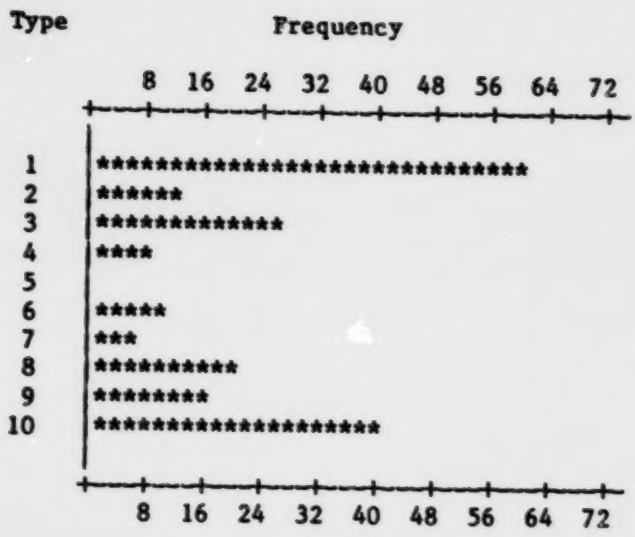
General Information on Questionaire Participants
by Type of Organization

Frequency Bar Chart



Type	Freq	Cum. Freq	Percent	Cum. Percent
1	59	59	29.80	29.80
2	13	72	6.57	36.37
3	26	98	13.13	49.50
4	7	105	3.54	53.04
5	0	105	0.00	53.04
6	10	115	5.05	58.09
7	6	121	3.03	61.12
8	21	142	10.60	71.72
9	16	158	8.08	79.80
10	40	198	20.20	100.00

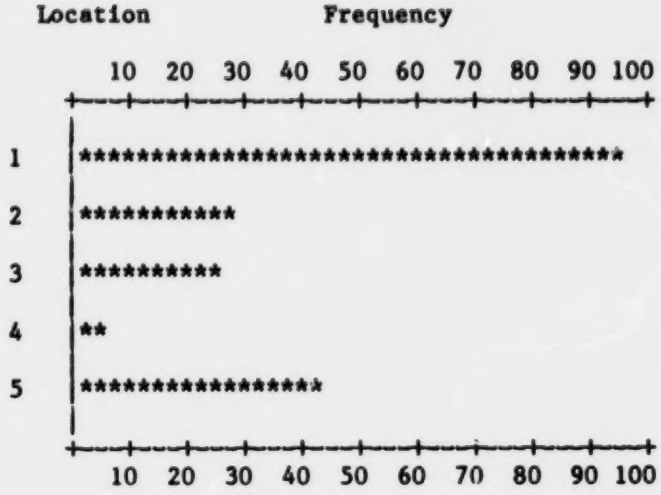
Type of Organization

1 = Mining Company
2 = Exploration Company
3 = Software Vendor
4 = University
5 = Other Educational
6 = Government Dept. (Federal)
7 = Government Dept. (Provincial)
8 = Consultant
9 = Other
10 = Not Specified

FIGURE No. 1

General Information on Questionaire Participants
by Location of Organization

Frequency Bar Chart



Location	Freq	Cum. Freq	Percent	Cum. Percent
1	96	96	48.48	48.48
2	29	125	14.65	63.13
3	27	152	13.64	76.77
4	4	156	2.02	78.79
5	42	198	21.21	100.00

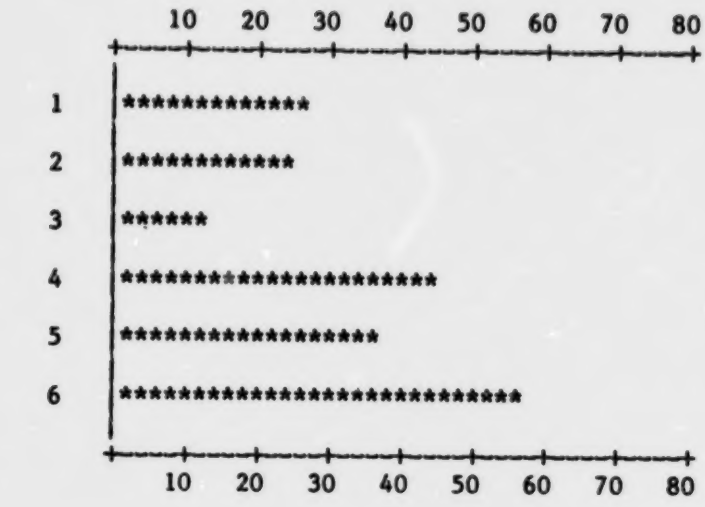
Location of Organization

1 = Head Office
2 = Branch Office
3 = Plant/Mine Site
4 = Other
5 = Not Specified

FIGURE No. 2

General Information on Questionaire Participants
by Organization Size (Employees in Canada)

Frequency Bar Chart



Class	Freq	Cum. Freq	Percent	Cum. Percent
1	26	26	13.13	13.13
2	23	49	11.62	24.75
3	12	61	6.06	30.81
4	44	105	22.22	53.03
5	36	141	18.18	71.21
6	57	198	28.79	100.00

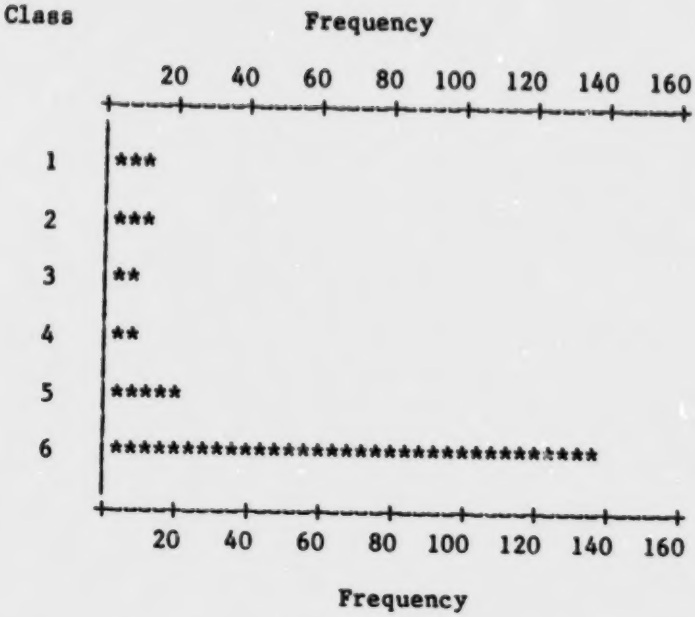
Organization Size (Employees in Canada)

1 = 1 - 10
2 = 11 - 50
3 = 51 - 100
4 = 101 - 500
5 = Over 500
6 = Not Specified

FIGURE No. 3

General Information on Questionaire Participants
by Organization Size (Employees Worldwide)

Frequency Bar Chart



Class	Freq	Cum. Freq	Percent	Cum. Percent
1	12	12	6.06	6.06
2	13	25	6.56	12.62
3	7	32	3.54	16.16
4	8	40	4.04	20.20
5	20	60	10.10	30.30
6	138	198	69.70	100.00

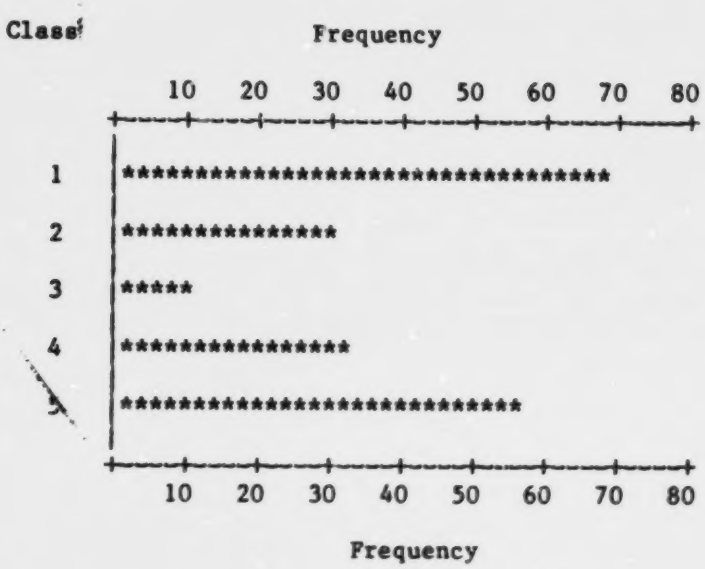
Organization Size (Number of Employees Worldwide)

1 = 1 - 10
2 = 11 - 50
3 = 51 - 100
4 = 101 - 500
5 = Over 500
6 = Not Specified

FIGURE No. 4

General Information on Questionaire Participants
by Number of Locations in Canada

Frequency Bar Chart



Class	Freq	Cum. Freq	Percent	Cum. Percent
1	69	69	34.85	34.85
2	30	99	15.15	50.00
3	10	109	5.05	55.05
4	32	141	16.16	71.21
5	57	198	28.79	100.00

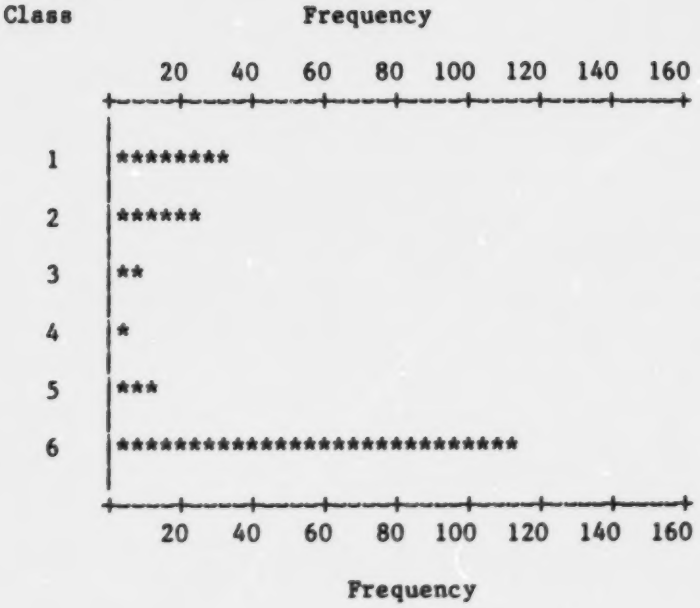
Organization by Number of Locations in Canada

1 = One Location
2 = Two Locations
3 = Three Locations
4 = Four to Ten Locations
5 = Not Specified

FIGURE No. 5

General Information on Questionaire Participants
by Number of Operating Mines in Canada

Frequency Bar Chart



Class	Freq	Cum. Freq	Percent	Cum. Percent
1	35	35	17.68	17.68
2	24	59	12.12	29.80
3	9	68	4.55	34.35
4	4	72	2.02	36.37
5	14	86	7.07	43.44
6	112	198	56.56	100.00

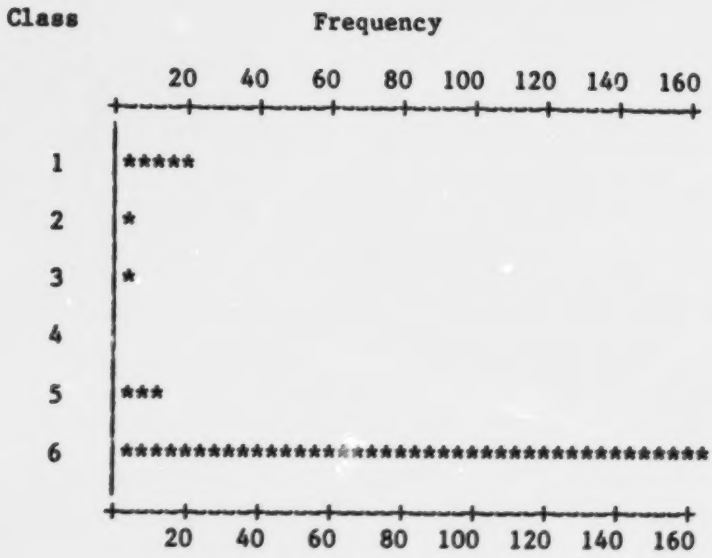
General Information on Survey Participants
by Number of Operating Mines in Canada

1 = No Mines
2 = One Mine
3 = Two Mines
4 = Three Mines
5 = Four to Ten Mines
6 = Not Specified

FIGURE No. 6

General Information on Questionaire Participants
by Number of Operating Mines Worldwide

Frequency Bar Chart



Class	Freq	Cum. Freq	Percent	Cum. Percent
1	19	19	9.60	9.60
2	4	23	2.02	11.62
3	2	25	1.01	12.63
4	0	25	0.00	12.63
5	10	35	5.05	17.68
6	163	198	82.32	100.00

General Information on Survey Participants
by Number of Operating Mines Worldwide

1 = No Mines
2 = One Mine
3 = Two Mines
4 = Three Mines
5 = Four to Ten Mines
6 = Not Specified

FIGURE No. 7

General Information on Questionaire Participants
by Type of Mining

Frequency Bar Chart

Class Frequency - HARD ROCK MINING

Class	20 40 60 80 100 120 140 160	Freq	Cum. Freq	Percent	Cum. Percent
1	********	33	33	16.67	16.67
2	*******	27	60	13.64	30.31
3	**********	138	198	69.69	100.00

Class Frequency

Class	20 40 60 80 100 120 140 160	Freq	Cum. Freq	Percent	Cum. Percent
4	**	9	9	4.54	4.54
5	******	23	32	11.62	16.16
6	**********	166	198	83.84	100.00

Frequency - SOFT ROCK MINING

General Information on Questionaire Participants
by Type of Mining

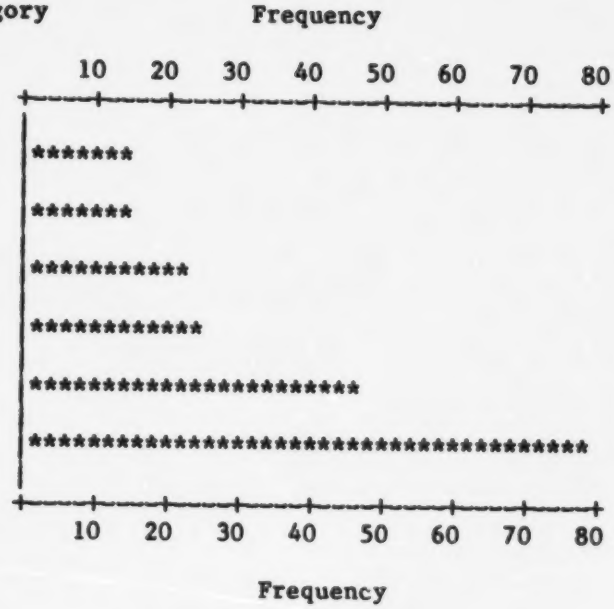
1 = Underground Hard Rock
2 = Surface Hard Rock
3 = Not Specified - Hard Rock

4 = Underground Soft Rock
5 = Surface Soft Rock
6 = Not Specified - Soft Rock

FIGURE No. 8

General Information on Questionaire Participants
by Mining Experience

Frequency Bar Chart



Category	Freq	Cum. Freq	Percent	Cum. Percent
1	15	15	7.58	7.58
2	15	30	7.58	15.16
3	21	51	10.60	25.76
4	24	75	12.12	37.88
5	45	110	22.73	60.61
6	78	198	39.39	100.00

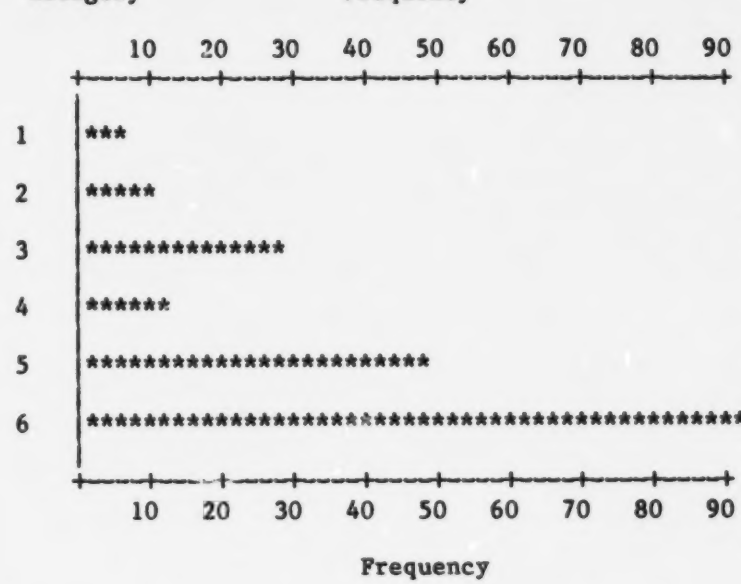
Organization by Mining Experience Category

1 = 0 - 5 years
2 = 5 - 10 years
3 = 10 - 15 years
4 = 15 - 20 years
5 = Over 20 years
6 = Not Specified

FIGURE No. 9

General Information on Questionaire Participants
by Exploration Experience

Frequency Bar Chart



Category	Freq	Cum. Freq	Percent	Cum. Percent
1	6	6	3.03	3.03
2	11	17	5.56	8.59
3	27	44	13.64	22.23
4	12	56	6.06	28.29
5	48	104	24.24	52.53
6	94	198	47.47	100.00

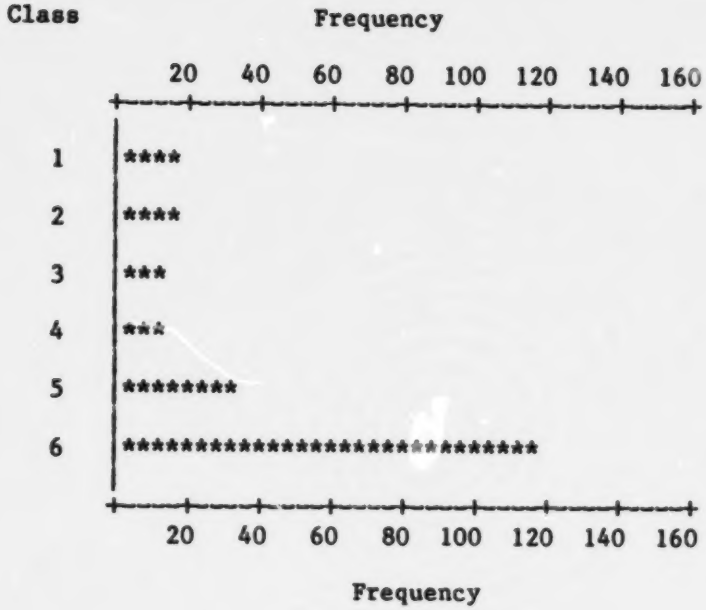
Organization by Exploration Experience Category

1 = 0 - 5 years
2 = 5 - 10 years
3 = 10 - 15 years
4 = 15 - 20 years
5 = Over 20 years
6 = Not Specified

FIGURE No. 10

General Information on Questionaire Participants
by Research & Development Experience

Frequency Bar Chart



Class	Freq	Cum. Freq	Percent	Cum. Percent
1	13	13	6.56	6.56
2	14	27	7.07	13.63
3	10	37	5.05	18.68
4	10	47	5.05	23.73
5	33	80	16.67	40.40
6	118	198	59.60	100.00

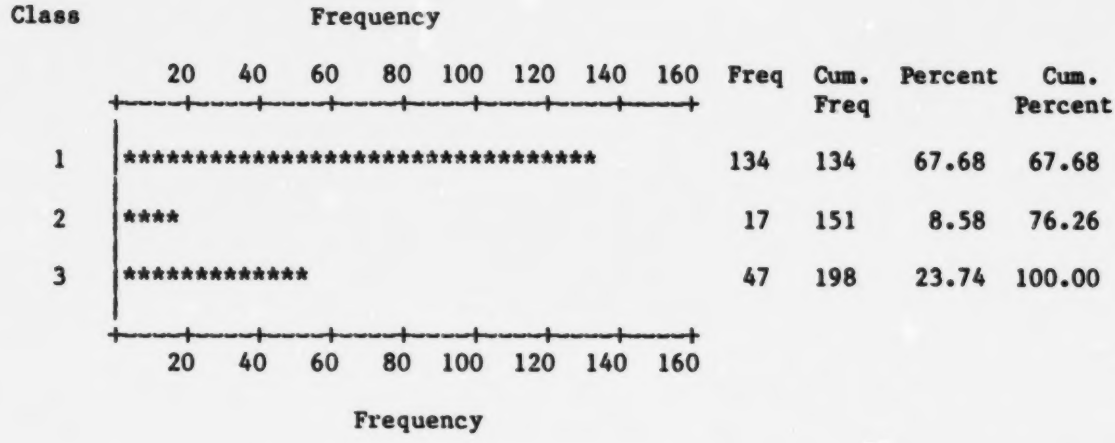
Research & Development Experience

1 = 0 - 5 Years
2 = 6 - 10 Years
3 = 11 - 15 Years
4 = 16 - 20 Years
5 = Over 20 Years
6 = Not Specified

FIGURE No. 11

General Information on Questionaire Participants
by Organization Use of Computers

Frequency Bar Chart



Class	Freq	Cum. Freq	Percent	Cum. Percent
1	134	134	67.68	67.68
2	17	151	8.58	76.26
3	47	198	23.74	100.00

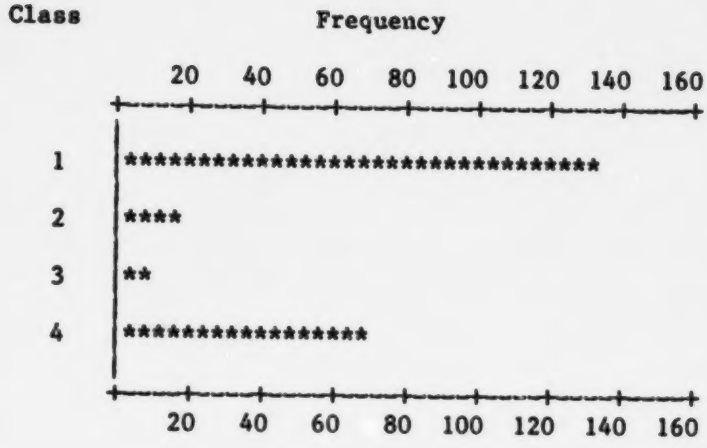
Organization Use of Computers

1 = Yes
2 = No
3 = Not Specified

FIGURE No. 12

General Information on Questionaire Participants
by Frequency of Computer Applications

Frequency Bar Chart



Class	Freq	Cum. Freq	Percent	Cum. Percent
1	111	111	56.06	56.06
2	17	128	8.59	64.65
3	6	134	3.03	67.68
4	64	198	32.32	100.00

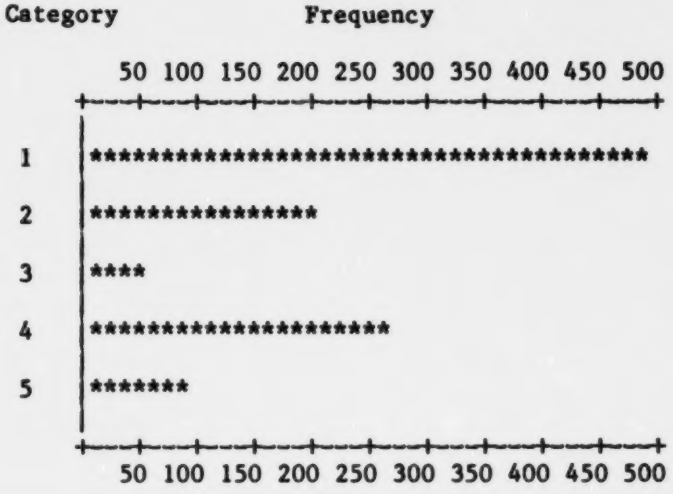
Frequency of Computer Applications

1 = Routine
2 = Partial
3 = Rare
4 = Not Specified

FIGURE No. 13

Mining Application Software
by Category

Frequency Bar Chart



Category	Freq	Cum. Freq	Percent	Cum. Percent
1	485	485	44.37	44.37
2	203	688	18.58	62.95
3	55	743	5.03	67.98
4	270	1013	24.70	92.68
5	80	1093	7.32	100.00

Mining Application Software
Category

1 = Exploration, Mine Design & Development

2 = Mine Production

3 = Safety & Environment

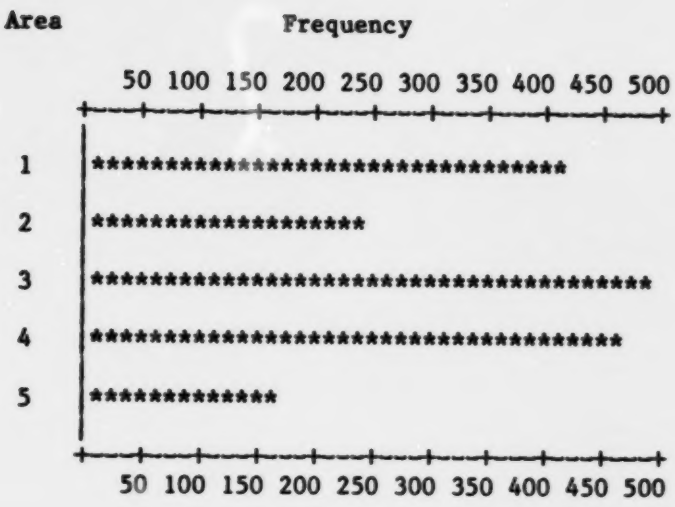
4 = Auxiliary Processes

5 = Not Specified

FIGURE No. 14

Mining Application Software
by Area of Application

Frequency Bar Chart



Area	Freq	Cum. Freq	Percent	Cum. Percent
1	409	409	23.29	23.29
2	245	654	13.95	37.24
3	486	1140	27.68	64.92
4	458	1598	26.08	91.00
5	158	1756	9.00	100.00

Mining Application Software
Area of Application

1 = Underground Hard Rock Mining

2 = Underground Soft Rock Mining

3 = Surface Hard Rock Mining

4 = Surface Soft Rock Mining

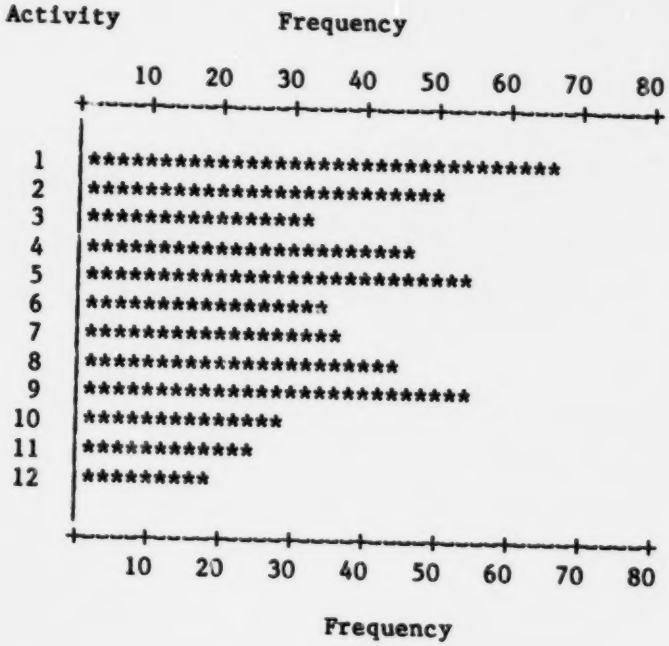
5 = Not specified

Note: The total number of modules is 1093, but the total here is 1756. This reflects the fact that some software modules are applicable to both surface and underground mining, and /or to both hard and soft rock.

FIGURE No. 15

Mining Application Software by Activity for
Exploration, Mine Design & Development

Frequency Bar Chart



Freq	Cum. Freq	%	Cum. %
66	66	13.61	13.61
50	116	10.31	23.92
32	148	6.60	30.52
46	194	9.48	40.00
54	248	11.14	51.14
33	281	6.80	57.94
36	317	7.42	65.36
44	361	9.07	74.43
54	415	11.14	85.57
28	443	5.77	91.34
24	467	4.95	96.29
18	485	3.71	100.00

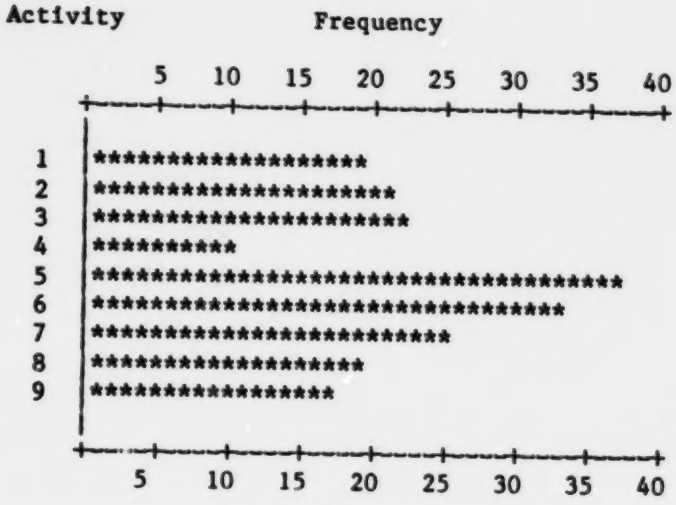
Mining Application Software for
Exploration, Mine Design & Development

Activity		Example
1 =	Data Management	
2 =	Reconnaisance Exploration	(Geochem,geophysics)
3 =	Target Investigation	(Drill core, assays)
4 =	Orebody Modelling	(Block & grid models)
5 =	Graphics	(Cross-sections,3-D)
6 =	Classical Statistics	
7 =	Geostatistics	(Variograms)
8 =	Ore Reserves	(Polygon, cube)
9 =	Mine Planning & Design	
10 =	Mine Evaluation	
11 =	Ultimate-Pit Analysis	
12 =	Other	

FIGURE No. 16

Mining Application Software by Activity for
Mine Production

Frequency Bar Chart



Activity	Freq	Cum. Freq	Percent	Cum. Percent
1	19	19	9.36	9.36
2	21	40	10.34	19.70
3	22	62	10.84	30.54
4	10	72	4.93	35.47
5	37	109	18.23	53.70
6	33	142	16.26	69.96
7	25	167	12.31	82.27
8	19	186	9.36	91.63
9	17	203	8.37	100.00

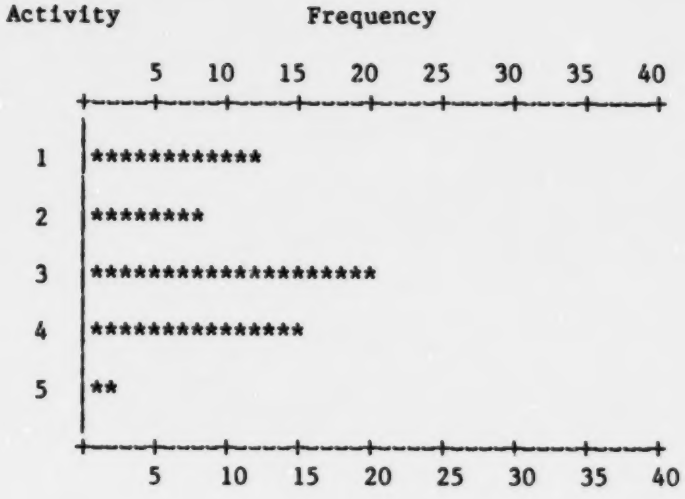
Mining Application Software for
Mine Production

Activity		Example
1	= Drilling, Breaking, Cutting	
2	= Material Loading	(Shovel, bucketwheel, conveyor)
3	= Material Transport	(Trucks, conveyor)
4	= Material Crushing	(Stationary, mobile)
5	= Mining Simulation	(Dragline, dispatch, U/G coal)
6	= Production Scheduling	
7	= Production Recording	
8	= Production Reporting	
9	= Other	(Monitoring, reclamation)

FIGURE No. 17

Mining Application Software by Activity for
Safety & Environment

Frequency Bar Chart



Activity	Freq	Cum. Freq	Percent	Cum. Percent
1	12	12	21.82	21.82
2	8	20	14.54	36.36
3	19	39	34.55	70.91
4	14	53	25.45	96.36
5	2	55	3.64	100.00

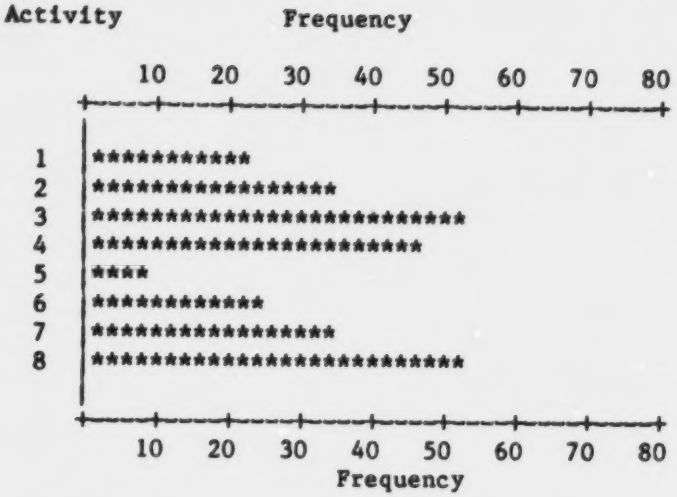
Mining Application Software for
Safety & Environment

Activity		Example
1	= Face Support	(Hydraul.props, slope control)
2	= Roadway Support	(Rockbolts, arches, side-slopes)
3	= Ventilation	
4	= Environment Monitoring	(Methane, radon, subsidence)
5	= Other	

FIGURE No. 18

Mining Application Software by Activity for
Auxiliary Processes

Frequency Bar Chart



	Freq	Cum. Freq	%	Cum. %
1	22	22	8.15	8.15
2	34	56	12.60	20.75
3	52	108	19.26	40.01
4	46	154	17.04	57.05
5	8	162	2.96	60.01
6	24	186	8.88	68.89
7	33	219	12.22	81.11
8	51	270	18.89	100.00

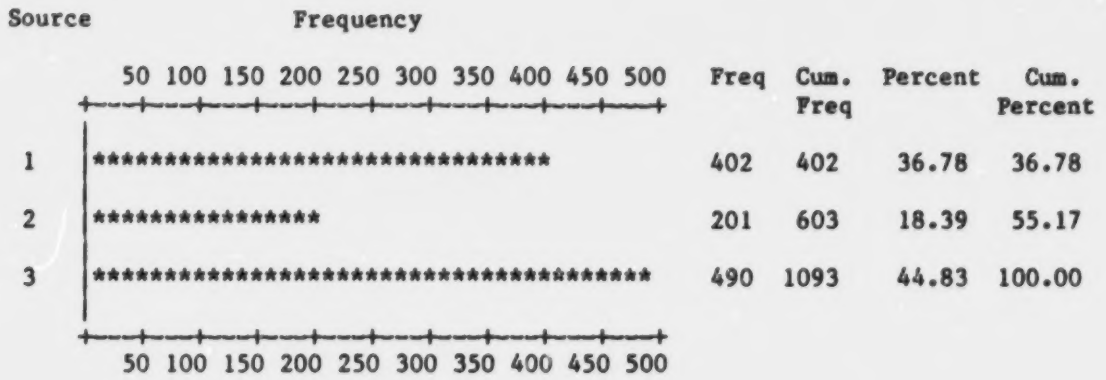
Mining Application Software for
Auxiliary Processes

	Activity	Example
1 =	Data management	
2 =	Engineering Calculations	(Flow diagrams)
3 =	Economic & Financial Analysis	(Cash flow, rate of return)
4 =	Soil & Rock Mechanics	
5 =	Communications	
6 =	Human Resources	(Personnel files)
7 =	Equipment Maintenance	(Preventive)
8 =	Other	(Cost control, accounting)

FIGURE No. 19

Mining Application Software
by Source of Development

Frequency Bar Chart



Source	Freq	Cum. Freq	Percent	Cum. Percent
1	402	402	36.78	36.78
2	201	603	18.39	55.17
3	490	1093	44.83	100.00

Mining Application Software
Source of Development

1 = Developed by Reporting Organization

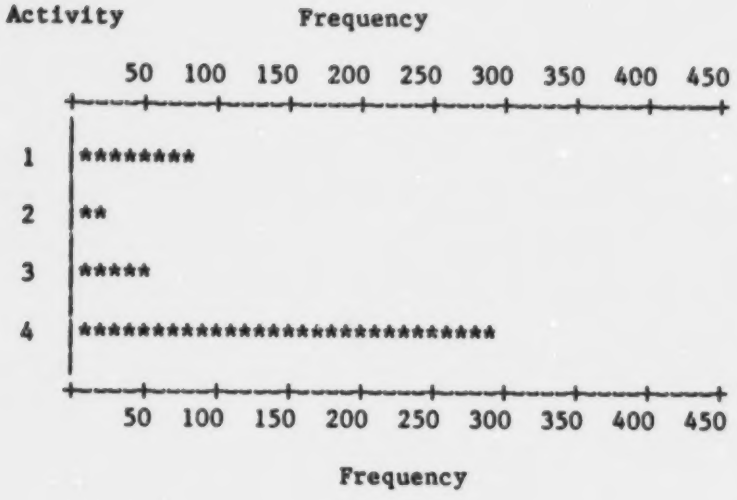
2 = Not Developed by Reporting Organization

3 = Not Specified

FIGURE No. 20

Mining Application Software
by Method of Development

Frequency Bar Chart



Activity	Freq	Cum. Freq	%	Cum. %
1	81	81	18.28	18.28
2	18	99	4.06	22.34
3	50	149	11.29	33.63
4	294	443	66.37	100.00

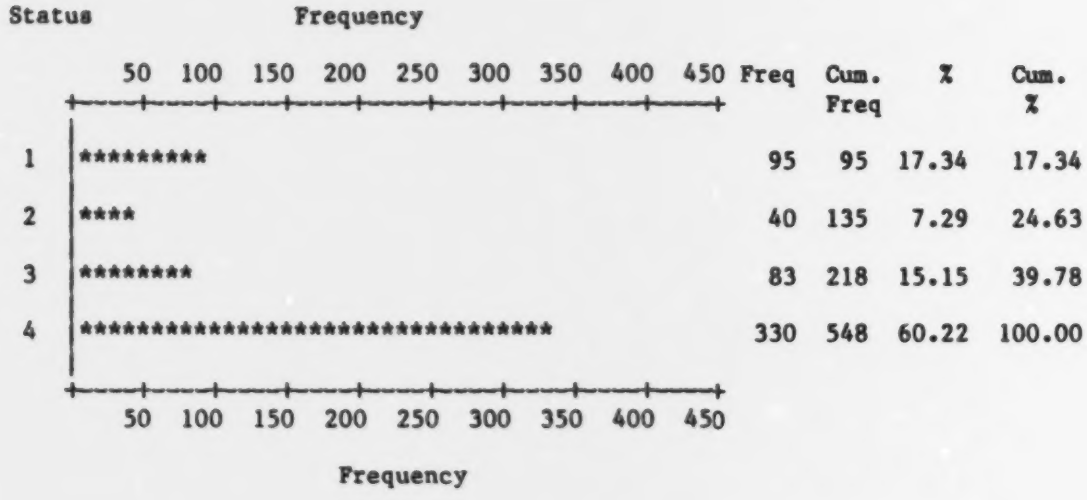
Mining Application Software
by Method of Development

1 = Developed from previous software - Major Modifications
2 = Developed from previous software - Minor Modifications
3 = Developed from previous software - unspecified Modifications
4 = Not developed from previous software

FIGURE No. 21

Mining Application Software
by Status of Program Development

Frequency Bar Chart



Status	Freq	Cum. Freq	%	Cum. %
1	95	95	17.34	17.34
2	40	135	7.29	24.63
3	83	218	15.15	39.78
4	330	548	60.22	100.00

Mining Application Software
by Status of Program Development

1 = Research and Development Phase

2 = Test Phase

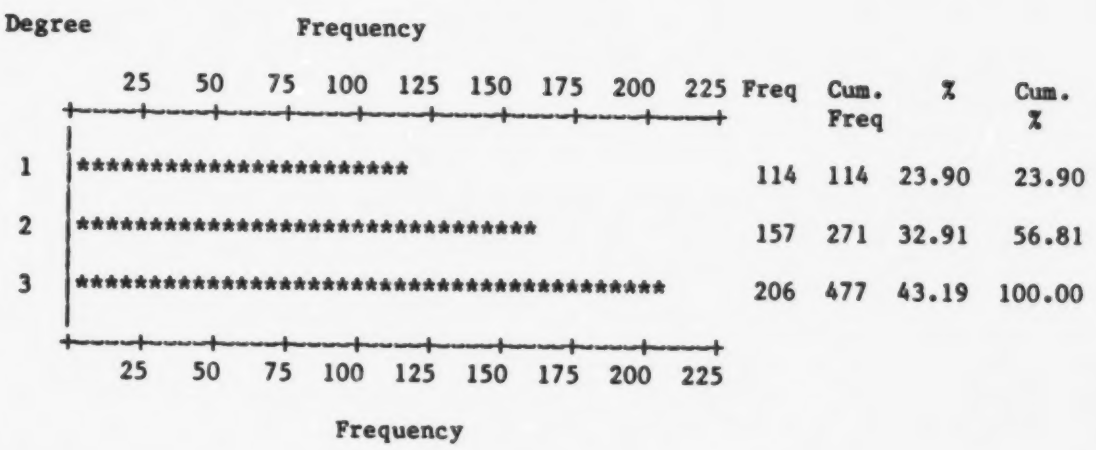
3 = Limited Production

4 = Full Production (including documentation)

FIGURE No. 22

Mining Application Software by
Degree of Program Applicability

Frequency Bar Chart



Degree	Freq	Cum. Freq	%	Cum. %
1	114	114	23.90	23.90
2	157	271	32.91	56.81
3	206	477	43.19	100.00

Mining Application Software by
Degree of Program Applicability

1 = Local / Specific / Unique Application

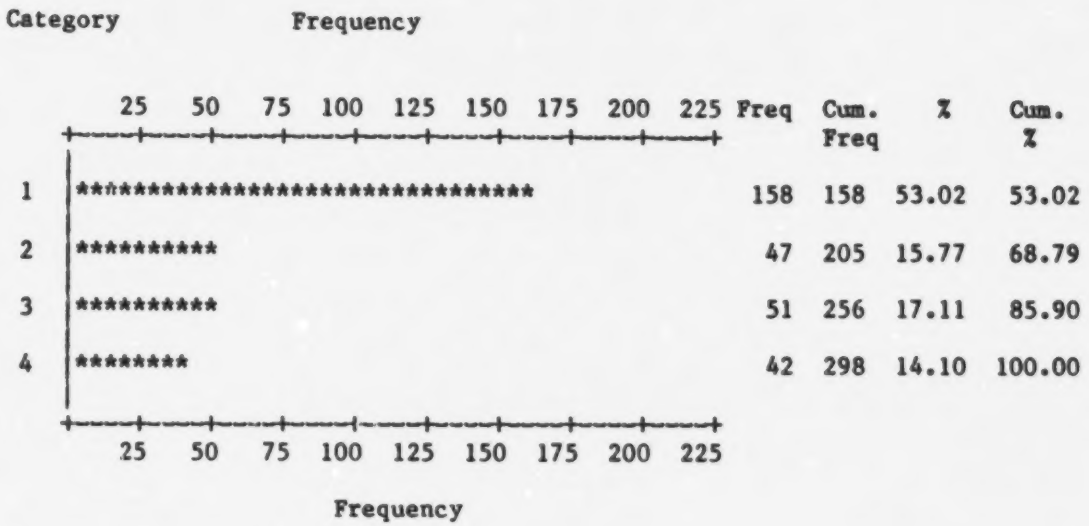
2 = Some generalization

3 = High degree of general applicability

FIGURE No. 23

Mining Application Software by
Method of Program Acquistion or Access

Frequency Bar Chart



Mining Application Software by
Method of Program Acquisition or Access

1 = Purchased

2 = Leased

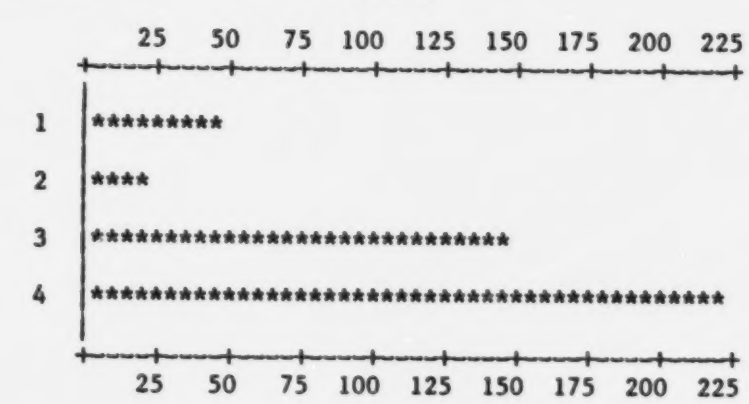
3 = Time-Sharing

4 = Service Bureau

FIGURE No. 24

Mining Application Software
by Degree of Program Support

Frequency Bar Chart



Category	Freq	Cum. Freq	%	Cum. %
1	43	43	10.02	10.02
2	22	65	5.13	15.15
3	143	208	33.33	48.48
4	221	429	51.52	100.00

Mining Application Software by
Degree of Program Support

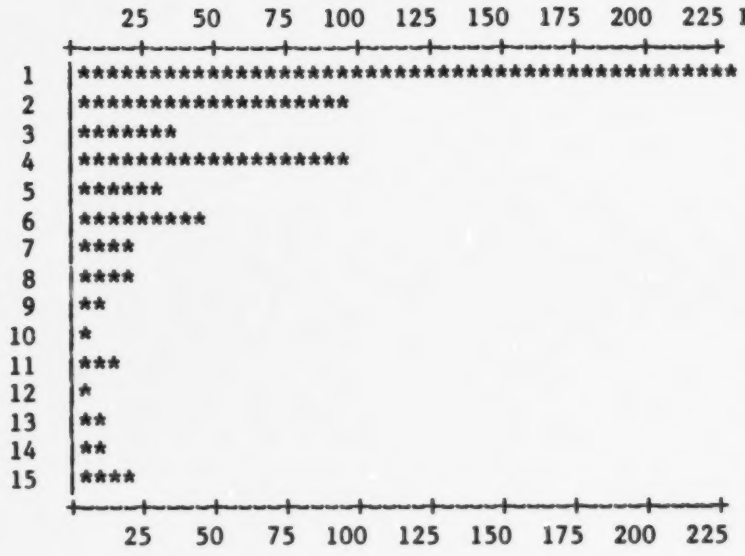
1 = None
2 = Poor
3 = Satisfactory
4 = Good

FIGURE No. 25

Mining Application Software
by Programming Language

Frequency Bar Chart

Language Frequency



Language	Freq	Cum. Freq	%	Cum. %
1	236	236	36.88	36.88
2	94	330	14.69	51.57
3	35	365	5.46	57.03
4	96	461	15.00	72.03
5	28	489	4.38	76.41
6	44	533	6.87	83.28
7	19	552	2.97	86.25
8	18	570	2.81	89.06
9	10	580	1.56	90.62
10	5	585	0.78	91.40
11	15	600	2.34	93.74
12	1	601	0.16	93.90
13	12	613	1.88	95.78
14	9	622	1.41	97.19
15	18	640	2.81	100.00

Frequency

Mining Application Software
by Programming Language

Language

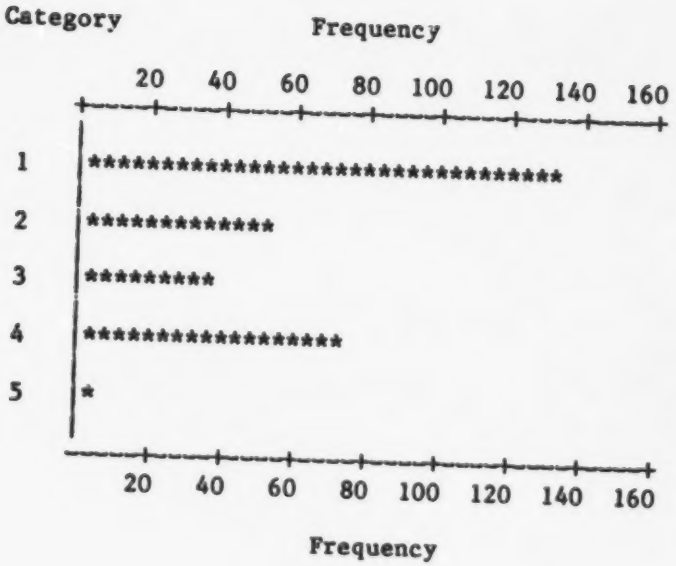
1 =	Fortran	7 =	PL/I
2 =	Fortran 77	8 =	RPG
3 =	Fortran IV	9 =	Pascal
4 =	Basic (not HP Basic)	10 =	C
5 =	HP Basic	11 =	Coral 66
6 =	Cobol	12 =	APL

13 =	Assembler	(Various Machines)
14 =	Data Base & Query Languages	(Various Machines)
15 =	Other	

FIGURE No. 26

RESEARCH ON COMMERCIAL SOFTWARE
Mining Application Software
by Category

Frequency Bar Chart



	Freq	Cum. Freq.	Percent	Cum. Percent
1	131	131	43.67	43.67
2	53	184	17.66	61.33
3	37	221	12.33	73.66
4	74	295	24.67	98.33
5	5	300	1.67	100.00

Mining Application Software
Category

1 = Exploration, Mine Design & Development

2 = Mine Production

3 = Safety & Environment

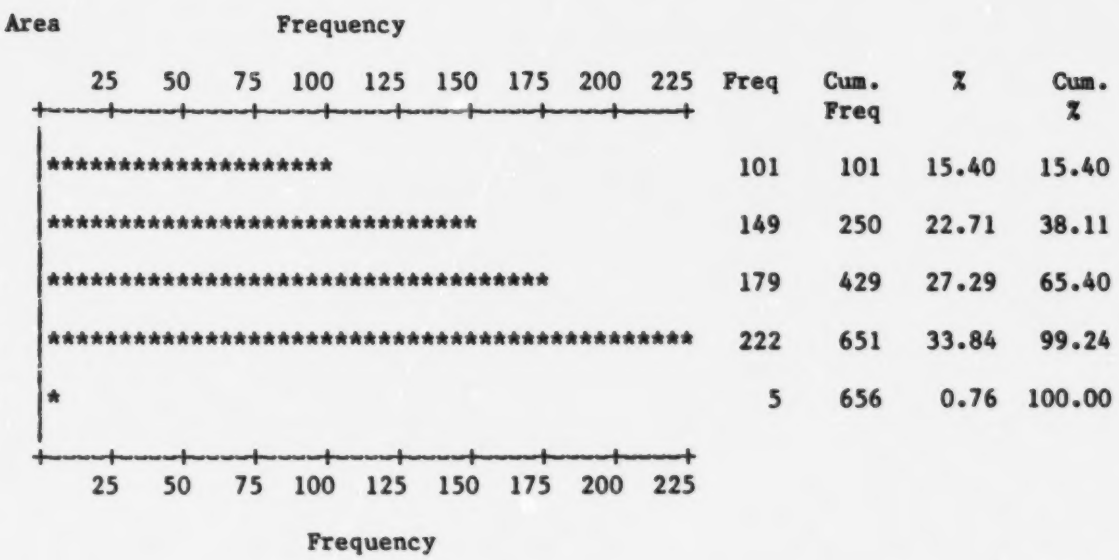
4 = Auxiliary Processes

5 = Not Specified

FIGURE No. 27

RESEARCH ON COMMERCIAL SOFTWARE
Mining Application Software
by Area of Application

Frequency Bar Chart



Area	Freq	Cum. Freq	%	Cum. %
1	101	101	15.40	15.40
2	149	250	22.71	38.11
3	179	429	27.29	65.40
4	222	651	33.84	99.24
5	5	656	0.76	100.00

Mining Application Software
Area of Application

1 = Underground Hard Rock Mining

2 = Underground Soft Rock Mining

3 = Surface Hard Rock Mining

4 = Surface Soft Rock Mining

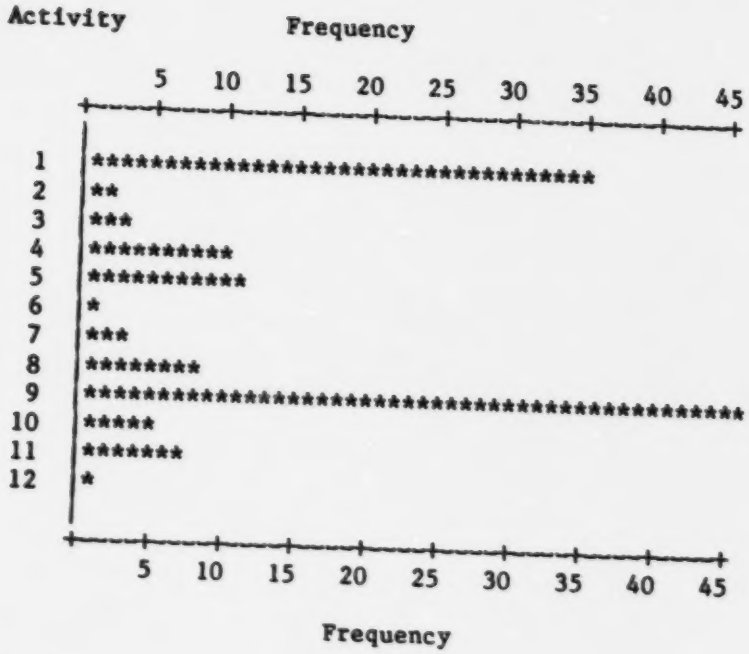
5 = Not specified

Note: The total number of modules is 300, but the total here is 656. This reflects the fact that some software modules are applicable to both surface and underground mining, and /or to both hard and soft rock.

FIGURE No. 27A

RESEARCH ON COMMERCIAL SOFTWARE
Mining Application Software by Activity for
Exploration, Mine Design & Development

Frequency Bar Chart



	Freq	Cum. Freq	%	Cum. %
1	34	34	25.95	25.95
2	2	36	1.53	27.48
3	3	39	2.29	29.77
4	10	49	7.63	37.40
5	11	60	8.40	45.80
6	1	61	0.76	46.56
7	3	64	2.29	48.85
8	8	72	6.11	54.96
9	46	118	35.11	90.07
10	5	123	3.82	93.89
11	7	130	5.34	99.24
12	1	131	0.76	100.00

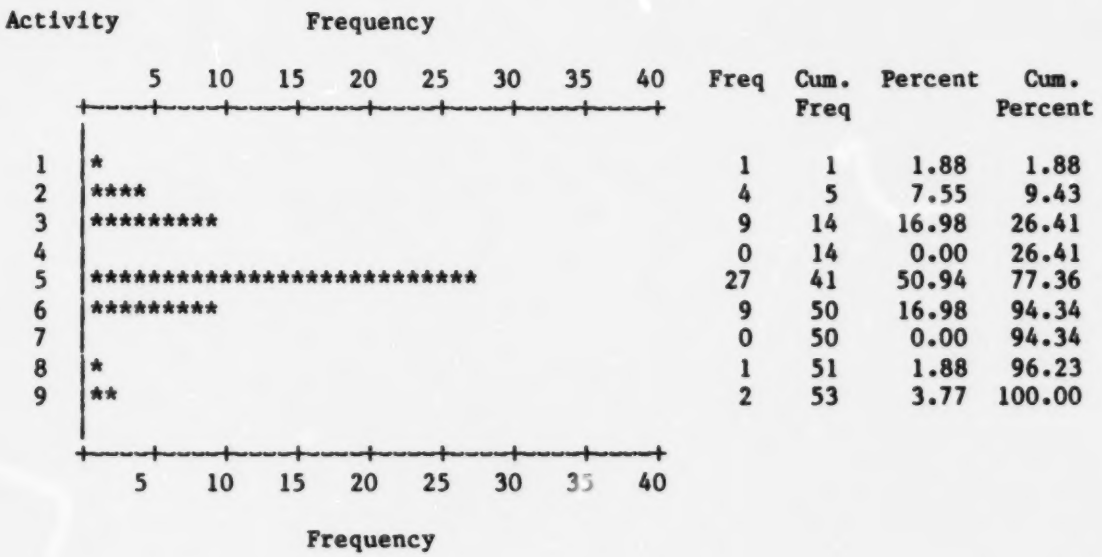
Mining Application Software for
Exploration, Mine Design & Development

Activity		Example
1	= Data Management	
2	= Reconnaisance Exploration	(Geochem,geophysics)
3	= Target Investigation	(Drill core, assays)
4	= Orebody Modelling	(Block & grid models)
5	= Graphics	(Cross-sections,3-D)
6	= Classical Statistics	
7	= Geostatistics	(Variograms)
8	= Ore Reserves	(Polygon, cube)
9	= Mine Planning & Design	
10	= Mine Evaluation	
11	= Ultimate-Pit Analysis	
12	= Other	

FIGURE No. 28

RESEARCH ON COMMERCIAL SOFTWARE
Mining Application Software by Activity for
Mine Production

Frequency Bar Chart



Activity	Freq	Cum. Freq	Percent	Cum. Percent
1	1	1	1.88	1.88
2	4	5	7.55	9.43
3	9	14	16.98	26.41
4	0	14	0.00	26.41
5	27	41	50.94	77.36
6	9	50	16.98	94.34
7	0	50	0.00	94.34
8	1	51	1.88	96.23
9	2	53	3.77	100.00

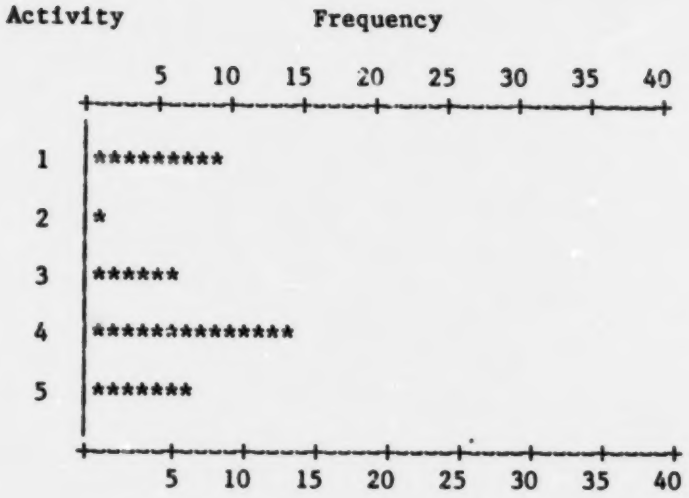
Mining Application Software for
Mine Production

Activity			Example
1	=	Drilling, Breaking, Cutting	
2	=	Material Loading	(Shovel, bucketwheel, conveyor)
3	=	Material Transport	(Trucks, conveyor)
4	=	Material Crushing	(Stationary, mobile)
5	=	Mining Simulation	(Dragline, dispatch, U/G coal)
6	=	Production Scheduling	
7	=	Production Recording	
8	=	Production Reporting	
9	=	Other	(Monitoring, reclamation)

FIGURE No. 29

RESEARCH ON COMMERCIAL SOFTWARE
Mining Application Software by Activity for
Safety & Environment

Frequency Bar Chart



Activity	Freq	Cum. Freq	Percent	Cum. Percent
1	9	9	24.32	24.32
2	1	10	2.70	27.02
3	6	16	16.22	43.24
4	14	30	37.84	81.08
5	7	37	18.92	100.00

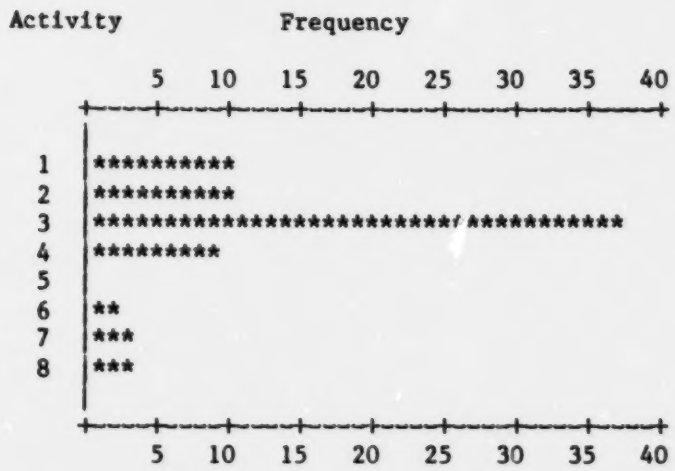
Mining Application Software for
Safety & Environment

	Activity	Example
1 =	Face Support	(Hydraul.props, slope control)
2 =	Roadway Support	(Rockbolts, arches, side-slopes)
3 =	Ventilation	
4 =	Environment Monitoring	(Methane, radon, subsidence)
5 =	Other	

FIGURE No. 30

RESEARCH ON COMMERCIAL SOFTWARE
Mining Application Software by Activity for
Auxiliary Processes

Frequency Bar Chart



Activity	Freq	Cum. Freq	%	Cum. %
1	10	10	13.51	13.51
2	10	20	13.51	27.02
3	37	57	50.00	77.03
4	9	66	12.16	89.19
5	0	66	0.00	89.19
6	2	68	2.70	91.89
7	3	71	4.05	95.95
8	3	74	4.05	100.00

Mining Application Software for
Auxiliary Processes

Activity		Example
1	= Data management	
2	= Engineering Calculations	(Flow diagrams)
3	= Economic & Financial Analysis	(Cash flow, rate of return)
4	= Soil & Rock Mechanics	
5	= Communications	
6	= Human Resources	(Personnel files)
7	= Equipment Maintenance	(Preventive)
8	= Other	(Cost control, accounting)

FIGURE No. 31

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SELECTED BIBLIOGRAPHY

Databases

- Canadian Data System List
- Compendex Database
- Computer Search
- Data-Tech. Skelly & Loy Company
- Dialog
- The International Software Database
- Rocky Mountain Resources Database

Directories

- Directory of Coal Mining Software
  - Coal Age Magazine, July 1983.
- Directory of Computer Programs Applicable to U.S. Mining Practices
  - R.L. Sanford, University of Alabama, 1982.
- Directory of Computer Models Applicable to the Coal Mining Industry
  - R.L. Cline, Colorado School of Mines, 1981, CSM Pres.
- Directory of Computer Programs Applicable to U.S. Mining Practices and Problems
  - R.L. Sandford, T.L. Myers, J.F. Stiehr, The University of Wisconsin, Platteville, 1977. U.S. Department of the Interior Bureau of Mines, November 1977.
- Directory of The Engineering Mining Journal.
- Directory of The Mining Association of Canada.
- Directory of The Coal Association of Canada.
- Directory of The Consulting Engineers of Canada.
- Canadian Mining Handbook, The Northern Miner.
- Directory of Government Agencies, Federal and Provincial.
- Southam Publications, Mailing List - Mining.

SIMONS

Publications

- Computer Refines Mine Operation
  - N.P. Chironis, Coal Age, March 1984.

- Computer Applications in Underground Mine Planning
  - J.F. Cook, Golder Associates, 84th Annual General Meeting, CIMM, 1982.

- Computer Simulation of Grade Distributions in Iron Ore Deposits
  - M. Dagbert, G. Sergerie, P.A. d'Haiti, J.M. Brodeur, Geostat Systems International, Quebec, CIMM Bulletin, October 1983.

- Operation Analysis Process Design, Process Control in Canadian Mineral Recovery and Metal Production Industries and the Petroleum Industry
  - B.D. Das, Chairman, CIMM, April 1983.

- Geostatistical Ore Reserve Estimation
  - M. David, Elsevier Scientific Publishing Co., New York, 1977.

- A Short Term Truck Scheduling in Open Pit Mines, Proceedings
  - M. Dessureault and A. Galibois, seminar on Scheduling in Mining, Smelting and Steelmaking, CIMM, October 1973.

- Computers
  - S. Evans, Mining Review, September/October 1984.

- Computer Organization and Programming
  - C.W. Gear, McGraw-Hill, 1974.

- Software Metrics
  - T. Gilb, Winthrop Publishers, 1977.

- Computer-Assisted Orebody Modelling for Underground Mines
  - J.D. Graham and E. Peterson, Control Data Corporation, 8th District, 4th Meeting of CIMM, 1984.

- Some Applications of Micro and Central Computing Facilities on a Hydro Project Construction Site
  - H.A. Hutchinson, D.C.W. Muir, H. Rother; H.A. Simons (International) Ltd. and Crippen Acres Saskatchewan, 25th CANCOLD Annual General Meeting, Saskatoon, Saskatchewan, July 1984.

- The UVAL Model: A Complete Exploration Model for the Economic Evaluation of Fund Reserves Using Probabilistic Risk Analysis
  - R.C. Kirkman, Proceedings, AIME Council of Economics, 1976.

Publications (Cont'd.)

- Statistical Analysis of Geological Data
  - G.S. Koch and R.F. Link; John Wiley & Sons, New York, 1970.

- Optimization of Open Pit Loading and Hauling Systems
  - F. Kostas and P.N. Calder, Queen's University, Ontario. Symposium on Surface Mining, Hydrology, Sedimentology and Reclamation, University of Kentucky, Lexington, Kentucky, 1984.

- Interactive Simulation of Underground Haulage Systems
  - D.C. MacAulay, Noranda Research Center, Quebec; and K.R. Notley, Queen's University, Ontario. Summer Computer Simulation Conference, Boston, July 1984.

- Proceedings of Seminar on Computer Modelling Applications in Surface Mining
  - R.J.C. MacDonald, CANMET, CIMM 4th Open Pit Operator's Conference, Alberta, September 1982.

- 1984 CADD Systems Survey
  - R. MacKay, Canadian Consulting Engineers, December.

- Geostatistical Determination of the Size and Grade of Ore-bodies by Computer Methods
  - Parker H. McDougal, Fluor Mining & Metals Inc. National Council for U.S.-China Trade Technical Exchange, Beijing, China, July 1977.

- Handbook of Operations Research, Volumes 1 and 2
  - J.J. Moder and S.E. Elmagraphy, Nostrand Reinhold Co., New York, 1978.

- Graphic Open Pit Mine Design System GPTMDS
  - D.C.W. Muir, 1984.

- Three-Dimensional Mine Drawings by Computer Graphics
  - K.R. Notley and E.B. Wilson, Queen's University, Ontario. CIMM Bulletin, February 1975.

- Evaluating CAE Software
  - W.K. Oliver, Northern Alberta Institute of Technology, Alberta. Hydrocarbon Processing, February 1985.

- Software Metrics
  - A. Perlis, F. Sayward, M. Shaw, MIT Press, 1981.

Publications (Cont'd.)

- Computers and Operation Research: Mine Usage
  - B.L. Seegmiller. SME Mining Engineering Handbook, A.B. Cummins and I.A. Given, editors, AIME, New York, 1973.

- Computer Methods for the 80's in the Mineral Industry
  - A. Weiss, Chairman, Society of Mining Engineers, AIME, 1979.

- Optimization of Mining Engineering Design in Mineral Valuation
  - H.M. Wells, Mining Engineering Volume 30, No. 12, December 1978. Trans. SME-AIME, Volume 264.

- APCOM Underscores Burgeoing Mineral Industries' Use of Computers
  - L. White, Engineering & Mining Journal, August 1984.

- Simulating Performance of a Coal Preparation Plant Based on Drillhole Data
  - P.S.K. Wong, H.A. Simons (International) Ltd. Summer Computer Simulation Conference, B.C., July 1983.

MARKETING LITERATURE AND BROCHURES, SOFTWARE VENDORS AND CONSULTANTS.

ACCUGRAPH CORPORATION: CAD on VAX.
ANALYTICAL DATA PROCESSING: Software package.
ARGOS SOFTWARE: ABECAS, PAYROLL
BAKER: Software package.
CEANET: Computer engineering applications, EXPLORER.
COMPUSERVE: Software package.
CONTROL DATA: Software package.
DATAPLOTTING: List of products and services.
DATASPHERE: Various sales literature.
ENERGY DATA SERVICES: Software package.
ERTEC: Minepack sstem.
EXPLORATION COMPUTER SERVICES: Minex.
FLUOR MINING & METALS INC.: software package.
GEMCOM: STEPS.
GEOMATH: Softawre package.
GEOMIN: Software package.
GEOSTAT SYSTEMS INTERNATIONAL INC.: Software package.
HAMAX DATA SYSTEMS: MINE MANAGER/3000.
HANNA MINING COMPANY: Software package.
IMSL: List of products and services
INSTITUTE NATURAL RESOURCES, MONTANA STATE UNIVERSITY: Control systems, surface mining
INTERGRAPH: Digital Terrain Models.
INTERNATIONAL GEOSYSTEMS CORPORATION: Software package.
KETRON, INC: Software package.
MANAGEMENT & PLANNING: IDSS.
MARKHURD: Software package.
MARSTON & MARSTON: Software package.
MATHTECH: Software package.
MCGILL UNIVERSITY: Nexus.
MINCOM : Software package.
MINE DATA COMPUTER SERVICES, INC.: Facts V.
MINERAL INDUSTRIES COMPUTING LIMITED: Software package.
MINERAL SERVICES INCORPORATED: Maintenace System.
MINING SOFTWARE ASSOCIATES: Software package.
MINTEC: Software package.
MODULAR MINING SYSTEMS: Dispatch.
MORRISON KNUDSEN: Software package.
MSU: SEAMPLAN
PERKIN-ELMER: Model 750.
PHOENIX CORPORATION: List of products and services.
PRECISION VISUALS: Software package.
R.T.Z. CONSULTANTS LIMITED: Software package.
REL-TECK: Software package.
RSI: ORACLE.
SIMONS (INTERNATIONAL) LTD., H.A.: Software package.
SIR, INC.: Database management sytem.
SIU: RECLA-MGM.
SYSTEM CONTROL, INC.: Software package.
SYSTEMS SPECIALIST, THE: Software package.
USBM: MINSTIM.
VIRGINIA POLYTECHNIC INST.: Software package.

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APPENDICES

Appendix 1A:	Questionnaire Form & Introductory Letter, in both official languages
Appendix 1B:	Total Questionnaires Mailed by Country/Province
Appendix 2:	Software Modules in Research & Development, Questionnaire Results
Appendix 3A:	Software Modules Available on International Market Research Results: Marketing Options, Areas of Application
Appendix 3B:	Software Modules Available on International Market Research Results: Module Names & Abstracts
Appendix 3C:	Software Modules With Marketing Options Questionnaire Results: Marketing Options, Areas of Application
Appendix 3D:	Software Modules With Marketing Options Questionnaire Results: Module Names, Abstracts and Company Names
Appendix 4A:	Systems Software, Application Support Libraries
Appendix 4B:	Systems Software, Device Support Software
Appendix 4C:	Systems Software, Data Management Software
Appendix 5:	Participants General Comments on Purchase Intentions, Computer Software & Hardware

APPENDIX 1A

Energy, Mines and Resources Canada
Research and Technology
Canada Centre for Mineral and Energy Technology,
555 Booth Street
Ottawa, Ontario
K1A 0G1

Énergie, Mines et Ressources Canada
Recherche et technologie
Centre canadien de la technologie des minéraux et de l'énergie,
555, rue Booth,
Ottawa (Ontario)
K1A 0G1

Your file Votre référence

Our file Notre référence

Dear Sir:

H.A. Simons (International) Ltd. has been retained by CANMET (Energy, Mines and Resources Canada) to identify and evaluate computer programs currently in use or available, and which are compatible with Canadian mining conditions. The project is one of several sponsored by CANMET regarding productivity in mine design and operational control.

Simons is now in the process of canvassing mining companies operating in Canada, and relevant government agencies, commercial software companies, universities, industry associations and consulting engineering firms. In order to provide as comprehensive a database as possible, Simons is also undertaking a survey of international software sources.

By this contract we hope to make available, primarily to the mining industry, but also to other interested and related agencies, the information on computer software that assists the mining sector both in the short term as well as in longer term research and development.

All material developed by Simons in carrying out the study will become the property of the Government of Canada; individual company wishes as to confidentiality of source will be respected. The results of the survey will be published and made available through the normal access to contract reports sponsored by CANMET.

Canada

If you have any questions regarding the nature or intent of this project, please feel free to contact any of the following project personnel:

Mr. Russell Boyle, CANMET, Tel.: (613) 996-4570 Ext. 122, (Ottawa)
Mr. Val Srajer, CANMET, Tel.: (403) 286-5512 (Calgary)
Mr. Rolando Espinoza, Simons Ltd., Tel.: 604-664-4315 (Vancouver)

This project has been initiated under the Short-Term Assistance in Research and Technology (START) Program, and your company's active participation in this project would be very much appreciated.

Yours sincerely,

W.G. Jeffery
Director-General, CANMET

APPENDIX 1A

Energy, Mines and Resources Canada
Research and Technology
Canada Centre for Mineral and Energy Technology,
555 Booth Street
Ottawa, Ontario
K1A 0G1

Énergie, Mines et Ressources Canada
Recherche et technologie
Centre canadien de la technologie des minéraux et de l'énergie,
555, rue Booth,
Ottawa (Ontario)
K1A 0G1

Your file Votre référence

Our file Notre ré

Monsieur,

CANMET (Énergie, Mines et Ressources Canada) a demandé à la société H.A. Simons (International) Ltd. de déterminer et d'évaluer les programmes machine actuellement utilisés ou disponibles qui sont compatibles avec les conditions prévalant dans le secteur minier au Canada. Il s'agit de l'un des nombreux projets exécutés sous l'égide du CANMET en ce qui concerne la productivité dans le contrôle opérationnel et la conception des mines.

La Simons procède maintenant à un sondage auprès des sociétés minières qui exécutent des travaux au Canada, des organismes gouvernementaux pertinents, des sociétés qui font le commerce des logiciels, des universités, des associations industrielles et des sociétés d'ingénieurs-conseils. En vue de fournir une base de données aussi vaste que possible, la Simons est également en train d'exécuter une enquête afin de déterminer les sources de logiciels internationales.

Au moyen de ce contrat, nous espérons pouvoir fournir, d'abord à l'industrie minière, mais également aux autres organismes connexes et intéressés, l'information en matière de logiciel qui aide le secteur minier à poursuivre ses travaux de recherche et développement à court et à long termes.

Canada

Tous les documents préparés par la Simons dans le cadre de l'étude deviendront la propriété du gouvernement du Canada; les sources des données demeureront confidentielles, sur demande des sociétés. Les résultats du sondage seront publiés et il sera possible de les obtenir par les voies habituelles qui donnent accès aux rapports concernant les contrats exécutés sous l'égide du CANMET.

Si vous avez besoin de renseignements supplémentaires au sujet de la nature ou de l'objectif de ce projet, n'hésitez pas à communiquer avec ces personnes-ci qui s'en occupent:

M. Russel Boyle, CANMET, Tél.: (613) 996-4570, Poste 122 (Ottawa)
M. Val Srajer, CANMET, Tél.: (403) 286-5512 (Calgary)
M. Rolando Espinoza, Simons Ltd., Tél.: (604) 664-4315 (Vancouver)

Ce projet a été mis en marche en vertu du Service temporaire d'aide à la recherche et à la technologie (START), et l'active participation de votre société à son exécution sera très appréciée.

Veuilez agréer, Monsieur, l'expression de mes sentiments les meilleurs.

Le Directeur général,
CANMET

W.G. Jeffery

QUESTIONNAIRE
for
Investigation of Computer Software and Hardware
In Surface and Underground Mining in Canada
Sponsored By
DEPARTMENT OF ENERGY, MINES & RESOURCES
CANMET

Instructions:

To answer the attached questionnaire please note the following guidelines.

1. The purpose of the survey is to provide a meaningful evaluation of issues affecting mining software utilization in Canada, please cooporate and provide as much detail as possible.

2. To complete this questionnaire inputs from personnel of various disciplines are required. Please circulate this questionnaire.

3. Subsidiaries of a major organization shall be considered as independent organizations. A separate questionnaire may have been sent to the parent organization. The parent company shall be considered as a service bureau if its software is utilized by the subsidiaries.

4. Please ignore the small numbers associated with each question. These will only be used for data tabulations and evaluations.

5. If a number of major user program/software modules and/or computer system software packages are being utilized by your Organization, please duplicate page 3 and 4 and complete these pages for each category.

6. Please answer with a tick mark in the boxes and print clearly on the segmented lines.

7. Please respond within 10–15 days of receipt of this questionnaire, or by August 8, 1984 at the latest.

PRIOR TO FILLING IN THE QUESTIONNAIRE, PLEASE READ THE INSTRUCTIONS
IGNORE THE SMALL NUMBERS IN EACH QUESTION

GENERAL INFORMATION

1. A) TYPE OF PARTICIPANT

1	Mining Company	[ ]
2	Exploration Company	[ ]
3	Software Vendor	[ ]
4	University	[ ]
5	Other educational institution	[ ]
6	Government Dept. (Federal)	[ ]
7	Government Dept. (Provincial)	[ ]
8	Consultant	[ ]
9	Other: _____	[ ]

2. B) PARTICIPANT'S LOCATION

1 Head Office [ ] 2 Branch office [ ]
3 Plant/Mine Site [ ] 4 Other _____ [ ]

3. C) ORGANIZATION SIZE (Number of employees)

		1 Canada	2 World
1	1–10	[ ]	[ ]
2	11–50	[ ]	[ ]
3	51–100	[ ]	[ ]
4	101–500	[ ]	[ ]
5	Over 500	[ ]	[ ]

4. D) NUMBER OF LOCATIONS IN CANADA

1 One [ ] 2 Two [ ]
3 Three [ ] 4 Four to ten [ ]

5. E) NUMBER OF OPERATING MINES
For mining company only

		1 Canada	2 World
1	None	[ ]	[ ]
2	One	[ ]	[ ]
3	Two	[ ]	[ ]
4	Three	[ ]	[ ]
5	Four to ten	[ ]	[ ]

Type of mining

		1 Hard Rock	2 Soft Rock
6	Underground	[ ]	[ ]
7	Surface	[ ]	[ ]

6. F) COMPANY/ORG'N EXPERIENCE

		1 Mining	2 Exploration	3 R & D
1	0 – 5 years	[ ]	[ ]	[ ]
2	5 – 10	[ ]	[ ]	[ ]
3	10 – 15	[ ]	[ ]	[ ]
4	15 – 20	[ ]	[ ]	[ ]
5	Over 20	[ ]	[ ]	[ ]

7. G) DOES YOUR ORGANIZATION USE COMPUTERS?

1 Yes [ ] 2 No [ ]

If "NO", please proceed to Pages 5 & 6,
PURCHASE INTENTIONS

8. H) FREQUENCY OF COMPUTER APPLICATIONS

1 ROUTINE [ ] 2 PARTIAL [ ] 3 RARE [ ]

9. I) DETAILS OF COMPUTER PERSONNEL

	NUMBER OF PEOPLE			
	Data Entry 1	Data Proc. 2	Tech. Appl'ns. 3	Systems/ Oper'ns. 4
JOB DESCRIPTION:				
1 Management				
2 Systems Analysts				
3 Programmer/Analysts				
4 Operators				
5 Other				
PRESENT TRAINING LEVEL AND FUTURE DEVELOPMENT:				
6 In-house (present)				
7 (planned)				
8 Course Work (present)				
9 (planned)				
10 Cert./Dipl. (present)				
11 (planned)				
12 Degree (present)				
13 (planned)				

10. J) OUTSIDE COMPUTER SERVICES UTILIZED

1	None	[ ]
2	Running own software at service bureau	[ ]
3	Running service bureau software	[ ]
4	Development Support	[ ]
5	Technical Consultation	[ ]
6	Plotting	[ ]
7	Keypunch/ Data Entry	[ ]
8	Digitizing	[ ]
9	Electronic Mail	[ ]
10	Commercial Database access	[ ]

Outside companies used: _____
_____
_____
_____

MINING APPLICATION SOFTWARE

PLEASE DUPLICATE AND COMPLETE THIS PAGE FOR EACH MAJOR PROGRAM MODULE IN THE SYSTEM

45 K) SYSTEM/MAJOR MODULE NAME: _____

46 L) FROM CHECKLIST (PAGE 2), ENTER:

1 Category No. 1[ ] 2[ ] 3[ ] 4[ ]
2 Area of Application 1[ ] 2[ ] 3[ ] 4[ ]
3 Mining Activity Description (enter No.) [ ]
If "OTHER", describe _____

47 M) PROGRAM USAGE DETAILS: (please use table on page 2 if you have versions for more than one computer)

1 Language _____
2 Computer used _____
3 Operating System _____
4 Program Size _____
5 Add'l requirement _____

48 N) PROGRAM/SOFTWARE ABSTRACT: _____

_____

_____

49 O) WAS THE PROGRAM DEVELOPED BY YOUR ORGANIZATION?

1 Yes [ ] -CONT. 2 No [ ] GO TO QUESTION 'Q'

50 P) IS IT BASED ON A PREVIOUSLY EXISTING PROGRAM?

1 Yes [ ] 2 No [ ]

Name of exist. program 3 _____

Modifications:

4 Minor ..... [ ]
5 Extensive ..... [ ]

STATUS

6 Research and Development phase ..... [ ]
7 Test phase ..... [ ]
8 Limited production ..... [ ]
9 Full production (incl. document.) ..... [ ]

APPLICATION:

10 Local/specific/unique ..... [ ]
11 Some generalization ..... [ ]
12 High degree of general applic'y ..... [ ]

GO TO QUESTION 'R'.

51 Q) PROGRAM NOT DEVELOPED IN-HOUSE

1 Supplier's Name: _____

52 R) METHOD OF ACQUISITION or ACCESS:

1 Purchased [ ] 2 leased [ ] 3 Timed-shared [ ]
4 Used via Service Bureau [ ]

53 S) EVALUATION OF SUPPORT:

	None 1	Poor 2	Satis 3	Good 4
1 Documentation	[ ]	[ ]	[ ]	[ ]
2 Training	[ ]	[ ]	[ ]	[ ]
3 Consulting	[ ]	[ ]	[ ]	[ ]

54 T) WHAT IS THE DEGREE OF USER SATISFACTION?

1 Low [ ] 2 Medium [ ] 3 High [ ]

55 U) WHAT CHANGE IS CONSIDERED?

1 None [ ] 2 Upgrade [ ] 3 Replace [ ]

56 V) STRENGTHS: _____

_____

57 W) LIMITATIONS: _____

_____

58 X) IF SYSTEM/PROGRAM IS MARKETED BY YOUR COMPANY:

OPTIONS AVAILABLE:

1 Purchase [ ]
2 Lease [ ]
3 Time-Share [ ]
4 Service Bureau [ ]

SUPPORT:

5 Documentation [ ]
6 Training [ ]
7 Technical Consulting [ ]

	1 Canada	2 World
8 Number of purch./lease clients:		
9 Number of other users:		

59 Y) HOST COMPUTER(S) FOR SOFTWARE:

WHEN Now 1	WHEN Fut. 2	TYPE* Mic 3	TYPE* Min 4	TYPE* Mfr 5	Manufacturer/ Model 6	Operating System 7	Mem. Req. (k bytes) 8	Additional Requirements (software, peripherals)
[ ]	[ ]	[ ]	[ ]	[ ]				
[ ]	[ ]	[ ]	[ ]	[ ]				
[ ]	[ ]	[ ]	[ ]	[ ]				
[ ]	[ ]	[ ]	[ ]	[ ]				

* Mic = MICRO/PERSONAL COMPUTER, Min = MINI COMPUTER, Mfr = MAINFRAME COMPUTER

PERIPHERALS

1. PRINTERS:

	Quantity	BRAND NAME	MODEL NAME or NUMBER
	1	2	3
80			
81			
82			

2. PLOTTERS:

	Quantity	BRAND NAME	MODEL NAME or NUMBER
	1	2	3
83			
84			

3. CRT's/GRAPHICS WORKSTATIONS:

	Quantity	BRAND NAME	MODEL NAME or NUMBER
	1	2	3
85			
86			
87			
88			

4. DIGITIZERS:

	Quantity	BRAND NAME	MODEL NAME or NUMBER
	1	2	3
89			
90			

5. TAPE DRIVES:

	Quantity	BRAND NAME	MODEL NAME or NUMBER
	1	2	3
91			
92			

6. SPECIALIZED PERIPHERALS:

	Quantity	BRAND NAME	MODEL NAME or NUMBER
	1	2	3
93			
94			

HARDWARE PURCHASE INTENTIONS

IF YOU ARE UNABLE TO GO INTO THE DETAIL THAT THE FOLLOWING TABLE REQUIRES, PLEASE USE THE SPACE ON NEXT PAGE FOR MORE GENERAL COMMENTS.

	CATEGORY	Quant.	PURPOSE Expand	Replace	Add	TIME FRAME (Months) 0–6	6–12	12+
	HARDWARE:	1	2	3	4	5	6	7
95	1 mainframe computer		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
96	2 mini computer		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
97	3 micro computer		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
98	4 peripherals:							
99	5 • plotter		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
100	6 • digitizer		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
101	7 • graphic stn.		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
012	8 • terminal		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
103	9 memory storage capacity		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
	10 Other _____		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

(Optional) Identify potential suppliers: _____

QUESTIONNAIRE
Enquête sur le recours d'ordinateur et au logiciel dans les mines à ciel ouvert et souterraines au Canada pour le compte du CANMET ministère de l'Énergie, des Mines et des Ressources

Instructions:

Pour bien répondre au questionnaire ci-joint, vous êtes prié d'observer les règles qui suivent.

1. L'enquête a pour objet de bien cerner les questions qui intéressent l'utilisation des logiciels dans les mines au Canada. Nous vous demandons donc de bien vouloir collaborer en nous fournissant le plus de précisions possible.

2. Pour bien répondre, il faudra faire appel à des spécialistes de diverses disciplines. Vous êtes donc prié de faire circuler le questionnaire.

3. Les filiales de grandes entreprises sont considérées comme des organes indépendants. Il se peut que la société-mère ait déjà reçu le questionnaire. Elle sera tenue pour un centre de traitement à façon si son logiciel est utilisé par les filiales.

4. Ne vous préoccupez pas des chiffres en petits caractères qui précèdent chaque question. Ils n'ont d'autre utilité que pour dresser des tableaux et faire l'évaluation des données.

5. Si votre organisme a recours à des modules de programmes utilisateurs ou de logiciels et à des systèmes d'exploitation importants, veuillez faire des copies des pages 3 et 4 et les remplir pour chaque catégorie.

6. Cochez les cases et écrivez en caractères imprimés dans les espaces réservés à cette fin.

7. Nous apprécierions recevoir vos réponses dans les 10 à 15 jours suivant la date de réception du questionnaire.

AVANT DE RÉPONDRE, LISEZ BIEN LES INSTRUCTIONS.
IGNOREZ LES NUMÉROS EN DÉBUT DE LIGNE.

RENSEIGNEMENTS GÉNÉRAUX

1. A) TYPE D'ORGANISME

1 Société minière	[ ]
2 Société d'exploration	[ ]
3 Fournisseur de logiciels	[ ]
4 Université	[ ]
5 Autre établissement d'enseignement	[ ]
6 Ministère fédéral	[ ]
7 Ministère provincial	[ ]
8 Consultant	[ ]
9 Autre_____	[ ]

2. B) LIEU

1 Administration centrale [ ] 2 Succursale [ ]
3 Usine/Chantier [ ] 4 Autre_____ [ ]

3. C) ENVERGURE DE L'ENTREPRISE (nombre d'employés)

	1 Au Canada	2 Dans le monde
1 de 1 à 10	[ ]	[ ]
2 de 11 à 50	[ ]	[ ]
3 de 51 à 100	[ ]	[ ]
4 de 101 à 500	[ ]	[ ]
5 plus de 500	[ ]	[ ]

4. D) NOMBRE D'ÉTABLISSEMENTS AU CANADA

1 Un [ ] 2 Deux [ ]
3 Trois [ ] 4 Entre quatre et dix [ ]

5. E) NOMBRE DE MINES EN EXPLOITATION
(sociétés minières uniquement)

	1 Au Canada	2 Dans le monde
1 Aucune	[ ]	[ ]
2 Une	[ ]	[ ]
3 Deux	[ ]	[ ]
4 Trois	[ ]	[ ]
5 Entre quatre et dix	[ ]	[ ]

Type d'exploitation

	1 Roche dure	2 Roche tendre
6 Abattage souterrain	[ ]	[ ]
7 Abattage en surface	[ ]	[ ]

6. F) ANNÉES D'ACTIVITÉ

	1 Exploitation minière	2 Exploration	3 R et D
1 Jusqu'à 5 ans	[ ]	[ ]	[ ]
2 de cinq à dix	[ ]	[ ]	[ ]
3 de dix à quinze	[ ]	[ ]	[ ]
4 de quinze à vingt	[ ]	[ ]	[ ]
5 Davantage	[ ]	[ ]	[ ]

7. G) AVEZ-VOUS RECOURS À DES ORDINATEURS?

1 Oui [ ] 2 Non [ ]

Dans la négative, passez aux pages 5 et 6,
INTENTIONS D'ACHAT

8. H) FRÉQUENCE D'UTILISATION DE L'ORDINATEUR

1 COURANTE [ ] 2 PARTIELLE [ ] 3 RARE [ ]

9. I) PERSONNEL AFFECTÉ À L'INFORMATIQUE

NOMBRE D'EMPLOYÉS

	Entrée des données 1	traitement 2	Appl. tech. 3	Exploit./ Syst. 4
GENRE DE TRAVAIL:				
1 Gestionnaire	_____	_____	_____	_____
2 Analyste fonctionnel	_____	_____	_____	_____
3 Programmeur/Analyste	_____	_____	_____	_____
4 Opérateur	_____	_____	_____	_____
5 Autre	_____	_____	_____	_____
NIVEAU ACTUEL DE FORMATION ET PERFECTIONNEMENT PRÉVU				
6 Internes (actuel)	_____	_____	_____	_____
7 (projeté)	_____	_____	_____	_____
8 Cours (actuel)	_____	_____	_____	_____
9 (projeté)	_____	_____	_____	_____
10 Cert./diplôme (actuel)	_____	_____	_____	_____
11 (projeté)	_____	_____	_____	_____
12 Grade (actuel)	_____	_____	_____	_____
13 (projeté)	_____	_____	_____	_____

10. J) RECOURS À DES SERVICES EXTÉRIEURS

1 Aucun	[ ]
2 Utilisation de votre logiciel au centre de traitement à façon	[ ]
3 Exploitation d'un logiciel appartenant au centre de traitement à façon	[ ]
4 Soutien au développement	[ ]
5 Consultation technique	[ ]
6 Traçage	[ ]
7 Perforation – introduction de données	[ ]
8 Numérisation	[ ]
9 Courrier électronique	[ ]
10 Accès à une base de données commerciale	[ ]

Fournisseurs de ces services: _____
_____
_____
_____

LOGICIEL APPLIQUÉ À L'EXTRACTION

REPRODUIRE ET COMPLÉTER CETTE PAGE POUR CHAQUE MODULE IMPORTANT DE PROGRAMMES

45. K) NOM DU SYSTÈME, DU MODULE

46. L) EN VOUS REPORTANT À LA PAGE 2, INSCRIVEZ

1 la catégorie 1[ ] 2[ ] 3[ ] 4[ ]
2 le champ d'application 1[ ] 2[ ] 3[ ] 4[ ]
3 l'activité minière (inscrire le numéro) [ ]
Si vous avez coché « Autre » à la page 2, donnez une description. _____

47. M) DÉTAIL D'EMPLOI DU PROGRAMME (veuillez vous servir du tableau de la page 3 si vous utilisez plus d'un ordinateur)

1 Langage _____
2 Ordinateur _____
3 Système d'exploitation _____
4 Longueur du programme _____
5 Besoins supplémentaires _____

48. N) DESCRIPTION SOMMAIRE DU PROGRAMME, DU LOGICIEL _____

49. O) LE PROGRAMME A-T-IL ÉTÉ CONÇU PAR VOTRE ENTREPRISE?

1 Oui [ ] (rép. à P) 2 Non [ ] (passer à Q)

50. P) REPOSE-T-IL SUR UN PROGRAMME ANTÉRIEUR?

1 Oui [ ] 2 Non [ ]
Nom du programme antérieur 3 _____
Modifications:
4 Légères . . . . [ ]
5 Importantes . . [ ]

ÉTAT D'ÉVOLUTION

6 À l'étape de R et D . . . . . [ ]
7 À l'essai . . . . . [ ]
8 Utilisation limitée . . . . . [ ]
9 Pleine utilisation (y compris la documentation) . . [ ]

APPLICATION

10 locale/précise/unique . . . . . [ ]
11 certaine généralisation . . . . . [ ]
12 Fort degré d'utilisation générale . . . . . [ ]
PASSEZ À LA QUESTION « R ».

51. Q) PROGRAMME DE L'EXTÉRIEUR

1 Nom du fournisseur _____

52. R) MODE D'ACQUISITION OU D'ACCÈS

1 Achat [ ] 2 Location [ ] 3 Temps partagé [ ]
4 Centre de traitement à façon [ ]

53. S) ÉVALUATION DU SOUTIEN: Nul Piètre Satisf. Bon

	1	2	3	4
1 Documentation	[ ]	[ ]	[ ]	[ ]
2 Formation	[ ]	[ ]	[ ]	[ ]
3 Consultation	[ ]	[ ]	[ ]	[ ]

54. T) À QUEL POINT EN ÊTES-VOUS SATISFAIT?

1 Peu [ ] 2 Moyennement [ ] 3 Beaucoup [ ]

55. U) QUELS CHANGEMENTS ENVISAGEZ-VOUS?

1 Aucun [ ] 2 Améliorations [ ]
3 Remplacement [ ]

56. V) POINTS FORTS: _____

57. W) LIMITATIONS _____

58. X) SI LE SYSTÈME EST COMMERCIALISÉ PAR VOTRE ENTREPRISE?

OPTIONS OFFERTES:		SOUTIEN:	
1 Achat	[ ]	5 Documentation	[ ]
2 Location	[ ]	6 Formation	[ ]
3 Temps Partagé	[ ]	7 Assistance technique	[ ]
4 Traitement à façon	[ ]		

	1 Au Canada	2 Dans le monde
8 Nombre de clients (achats et locations)		
9 Nombre d'autres usagers		

59. Y) ORDINATEUR(S) CENTRAL(AUX) DES LOGICIELS:

QUAND Prés.	QUAND Fut.	TYPE* Micro	TYPE* Mini	TYPE* Central	Nom du fabricant/ modèle (6)	Mode d'exploitation (7)	Mémoire requ. (kilo-octets) (8)	Besoins supplémentaires (logiciels, périphériques)
[ ]	[ ]	[ ]	[ ]	[ ]				
[ ]	[ ]	[ ]	[ ]	[ ]				
[ ]	[ ]	[ ]	[ ]	[ ]				
[ ]	[ ]	[ ]	[ ]	[ ]				

*Micro = ORDINATEUR PERSONNEL; Mini = MINI-ORDINATEUR; Central = ORDINATEUR PRINCIPAL

1. IMPRIMANTES:

	Quantité	MARQUE DESCRIPTIVE	NOM ou NUMÉRO DE MODÈLE
	1	2	3
80.			
81.			
82.			

2. TRACEURS:

	Quantité	MARQUE DESCRIPTIVE	NOM ou NUMÉRO DE MODÈLE
	1	2	3
83.			
84.			

3. ÉCRANS CATH./POS. GRA.:*

	Quantité	MARQUE DESCRIPTIVE	NOM ou NUMÉRO DE MODÈLE
	1	2	3
85.			
86.			

4. CONVERT. ANAL./NUM.:**

	Quantité	MARQUE DESCRIPTIVE	NOM ou NUMÉRO DE MODÈLE
	1	2	3
89.			
90.			

5. DÉROULEURS DE BANDE

	Quantité	MARQUE DESCRIPTIVE	NOM ou NUMÉRO DE MODÈLE
	1	2	3
91.			
92.			

6. PÉRIPHÉRIQUES SPÉCIALISÉS:

	Quantité	MARQUE DESCRIPTIVE	NOM ou NUMÉRO DE MODÈLE
	1	2	3
93.			
94.			

INTENTIONS D'ACHAT DE MATÉRIEL

SI VOUS NE POUVEZ ÊTRE AUSSI PRÉCIS QUE LE VEUT LE TABLEAU,
SERVEZ-VOUS DE LA PARTIE DE LA PAGE 6 POUR FAIRE DES COMMENTAIRES.

	CATÉGORIE	Quantité	UTILISATION: Expansion	UTILISATION: Remplacement	UTILISATION: Addition	DANS COMBIEN DE MOIS: 0–6	DANS COMBIEN DE MOIS: 6–12	DANS COMBIEN DE MOIS: 12+
	MATÉRIEL:	1	2	3	4	5	6	7
96.	1 ordinateur central		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
98.	2 mini-ordinateur		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
97.	3 micro-ordinateur		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
98.	4 périphériques:							
99.	5 * traceur		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
100.	6 * convertisseur		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
101.	7 * poste de graphisme		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
102.	8 * terminal		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
103.	9 capacité de stockage		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
104.	10 autre _____		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

(facultatif) Nommez les fournisseurs éventuels: _____

*3. Écrans cathodiques/Postes de graphisme.

*4. Convertisseurs analogiques/numériques.

SIMONS

APPENDIX 1B

Total Number of Questionnaires Mailed
Distribution by Country/Province

Country	Province	No. of Questionnaires English Version	No. of Questionnaires French Version
Australia		7	
Canada	Alberta	120	
	British Columbia	96	
	Manitoba	13	
	New Brunswick	14	8
	Newfoundland	10	
	Nova Scotia	16	
	Northwest Territories	4	
	Ontario	222	
	Prince Edward Island	1	
	Quebec	76	55
	Saskatchewan	20	
	Yukon	5	
	Total Canada	597	63
Federal Republic of Germany		1	
India		1	
South Africa		3	
United Kingdom		5	
United States of America		102	
Zambia		1	
Zimbabwe Rhodesia		1	
	TOTAL	718	63

APPENDIX 2
SOFTWARE MODULES IN RESEARCH AND DEVELOPMENT
QUESTIONNAIRE RESULTS

LEGEND:
Activit = 1 to 44, see Questionnaire form, Appendix 1A
Application: 1 & 2 underground mining, hard and soft rock respectively
2 & 3 surface mining, hard and soft rock respectively
Module name = Xi, existing module, no name given by participant
= Yi, module wanted by participant

ACTIVITY NO	MODULE NAME	APPLICATION AREA 1	AREA 2	AREA 3	AREA 4	ABSTRACT
11	GMOD1				1	GRID MODEL USING GEOSTAT FOR VOL/GRADE EST
11	FORIG1			1		
11	Y1			1	1	
11	UG -I.S.1	1	1	1	1	COMPLETE PACKAGE.D.H-INFO TO PROJECT EVALUATION & PLANNING
12	UG -I.S.2	1	1	1	1	EXPLORATION D.HANDLING SYSTEM,ASSAYS,GEOCHEM,ETC
12	FORIG2			1		
12	X1			1		
13	UG -I.S.3	1	1	1	1	EXPLORATION TARGET INVESTIGATION SYSTEM,D.CORES,ETC.
13	FORIG3	1	1			
13	LOGGER			1	1	BOREHOLE GEOPHYSICS CORRECTIONS AND DISPLAY
13	GMOD2				1	GRID MODEL USING GEOSTAT FOR VOL/GRADE EST
14	UG -I.S.4	1	1	1	1	POLYGON AND BLOCK MODELING,CONVENTIONAL AND GEOSTAT TECHNIQU
14	FORIG4	1	1			
14	Y2			1	1	
14	GMOD3				1	GRID MODEL USING GEOSTAT FOR VOL/GRADE EST
15	SHL-GIS	1	1	1	1	GENERAL PURPOSE MAPPING,EARTH RESOURCE ANLYSIS&GEOGR INFO
15	UG -I.S.5	1	1	1	1	INTERACTIVE GRAPHIC AND LAYOUT DEVELOPMENT DESIGN
15	SURFACE II	1	1	1	1	USES SURFACE II SYSTEM IN SPECIAL APPLICATIONS
15	FORIG5	1	1			
15	Y3			1	1	
15	GMOD4				1	GRID MODEL USING GEOSTAT FOR VOL/GRADE EST
16	UG -I.S.6	1	1	1	1	CONVENTIONAL AND GEOSTATISTICS MODELING
16	FORIG6	1	1	1		
16	GMOD5				1	GRID MODEL USING GEOSTAT FOR VOL/GRADE EST
17	UG -RC5	1	1	1		PLANS GEOSTAT PROGRM FOR MEMLO/DESIGN FOR NUGGET EFFECTS

APPENDIX 2

SOFTWARE MODULES IN RESEARCH AND DEVELOPMENT
QUESTIONNAIRE RESULTS

LEGEND:
Activity = 1 to 44, see Questionnaire form, Appendix 1A
Application: 1 & 2 underground mining, hard and soft rock respectively
2 & 3 surface mining, hard and soft rock respectively
Module name = Xi, existing module, no name given by participant
= Yi, module wanted by participant

ACTIVITY NO	MODULE NAME	APPLICATION AREA 1	AREA 2	AREA 3	AREA 4	ABSTRACT
17	FORIG7	1	1	1		
17	GMOD6				1	GRID MODEL USING GEOSTAT FOR VOL/GRADE EST
17	X1			1		
18	UG -I.S.7	1	1	1	1	ORE RESERVES,HARD ROCK AND POTASH-BLOCKS & POLYGONS
18	Y4			1	1	
18	FORIG8	1	1			
18	GMOD7				1	GRID MODEL USING GEOSTAT FOR VOL/GRADE EST
18	X2			1		
19	UG -I.S.8	1	1	1	1	PROGRAM FOR O.PIT DESIGN,INTERACTIVE DESIGN OF DEVELOPMNT LA
19	Y5			1	1	
19	UG -ISD4	1	1	1		RAMP DESIGN SYST-U/G.MINES,INTERACTIVE GRAPHICS, 3D
20	Y6			1	1	
20	X3			1		
20	MINECOST				1	MINE COST AND BUDGET ESTIMATION
21	Y7			1	1	
21	X4			1		
23	UG -RC3	1	1	1		PLANS IMPROVMNT ON CANMETS OPEN STOPE BLASTING-PATTERN PROG
23	EP-S7					MONITOR DRILLING/TAILORS BLASTS,OPTIMIZATION,RES.IN SWEDEN
23	Q.U.-S2			1		R&D ON DRILLING AND BLASTING PATTERNS
23	Y8				1	
24	EVENT-CONV	1	1	1		EVENT-BASED MODEL OF CONVEYOR OPERATIONS IN OIL SANDS
24	CONVEYOR-M	1	1	1		MATHTCAL MODEL POWER REQRMNT FOR DIFFERENT CONVEYOR DESIGNS
24	Y9				1	
24	UG -GECO	1	1	1	1	MODELS THE FLOW OF MUCK IN SUBLEVEL STOPING/SLUSHERS
24	GMODB				1	GRID MODEL USING GEOSTAT FOR VOL/GRADE EST
25	T/SEVNTBSD			1	1	EVENTBASED MODEL OF TRUCK/SHOVEL/LOADER OPERATIONS

APPENDIX 2
SOFTWARE MODULES IN RESEARCH AND DEVELOPMENT
QUESTIONNAIRE RESULTS

LEGEND:
Activity = 1 to 44, see Questionnaire form, Appendix 1A
Application: 1 & 2 underground mining, hard and soft rock respectively
2 & 3 surface mining, hard and soft rock respectively
Module name = Xi, existing module, no name given by participant
= Yi, module wanted by participant

ACTIVITY NO	MODULE NAME	APPLICATION AREA 1	AREA 2	AREA 3	AREA 4	ABSTRACT
25	T/S-MATH'K			1	1	MATHCAL MODEL CALCULATE CYCLETIME OF TRUCK/SHOVEL/LOADER
25	Y10				1	
25	GMOD9				1	GRID MODEL USING GEOSTAT FOR VOL/GRADE EST
26	Y11				1	
27	BIN/HOPPER	1	1	1		EVENT-BASED MODEL OF BIN/HOPPER OPERATIONS IN OIL SANDS
27	D/L-MATH/M				1	MATHMCAL/GEOMETRICAL DRAGLINE OPERTN MODELLING OIL SANDS
27	Y12				1	
27	D/LEVNTBSD				1	EVENTBASED MODEL DRAGLINE OPERTN'BUILDING OILSAND WINDROW
27	B/W-MODEL			1		EVENTBASED MODEL BUCKETWHEEL OPERTN IN OIL-SANDS
27	GMOD10				1	GRID MODEL USING GEOSTAT FOR VOL/GRADE EST
28	STRIPS				1	INTERACTIVE SHORT RANGE SCHEDULING
28	UG -I.S.9	1	1	1	1	SEVERAL PROD.SCHEDULING SYSTEMS AT VARIOUS LEVELS OF DETAIL
28	MINESCHED	1	1			CRITICAL PATH&RESOURCE ALLOCTN SCHEDULING
28	Y13				1	
28	GMOD11				1	GRID MODEL USING GEOSTAT FOR VOL/GRADE EST
29	PRESTA			1		PRODUCTION EQUIPMENT ACCTNG AND STATISTCS SYSTEM
29	Y14				1	
30	Y15				1	
31	SURVEY				1	CONTROLPOINTS,PLOTTING,ELECTRN OTEBOOK,VOLUMES
31	BLASTHOLE	1	1			GRAPHICLY REPRESENTS OPEN STOPE BLASTS FOR BURDEN SPACINGS
31	Y16				1	
32	Y17					
33	Y18					
34	Y19					

APPENDIX 2
SOFTWARE MODULES IN RESEARCH AND DEVELOPMENT
QUESTIONNAIRE RESULTS

LEGEND:
Activity = 1 to 44, see Questionnaire form, Appendix 1A
Application: 1 & 2 underground mining, hard and soft rock respectively
2 & 3 surface mining, hard and soft rock respectively
Module name = Xi, existing module, no name given by participant
= Yi, module wanted by participant

ACTIVITY NO	MODULE NAME	APPLICATION AREA 1	AREA 2	AREA 3	AREA 4	ABSTRACT
35	OCC-EXPSR					LIFETIME CONTMNTS RECORDS:RADON,THARON,GAMMA,DUST,SIO2,NOISE
35	Y20					
37	UG -I.S.10	1	1	1	1	LARGE MATERIAL MANAGEMENT AND PURCHASING SYSTEMS,INTERNLLY D
38	UG -RC6	1	1	1		NUMERICAL MODELING/BOUNDARY ELEMENT APPROACH-3YEARS PROGR
38	Y21				1	
39	UG -FIN	1	1	1	1	NORANDA DEVELOPED FINANCIAL EVALUATION PACKAGE
39	LOTUS	1	1	1	1	USES LOTUS-SPREAD SHEETS IN FINANCIAL ANALYSIS
39	SUPERCALC	1	1	1	1	USES SUPERCALC SPREAD SHEETS IN FINANCIAL EVALUATIONS
39	FIN-A				1	VARIOUS FINNANCIAL ANALYSIS STUDIES
39	Q.U.-S3	1	1	1		FINANC-ANALYSIS INCLUDING DETAILED TAX CALCLTNS ON/Q/BC
39	Y22				1	
39	IFPS	1	1	1	1	USES IFPS AND LOTUS,SUPERCALC,ETC
40	UG -RC1	1	1	1		INSTRUMENT DATABASE ON HP9816 MIC
40	NUMERCLMOD	1	1			FINITE ANALYSIS CALCULATIONS
40	MICROSISMC	1	1			COLLECTION OF MICROSISMIC DATA FOR ANALYSIS
40	ROCK STAB	1	1			RAPPORT DE STABILITE
40	Y23				1	
43	UG -MAINT	1	1	1	1	SEVERAL MAINTENANCE SYSTEMS DEVELOPED BY OPERATOR
43	PM				1	MAINTENANCE SCHEDULING&CONTROL
43	Y24				1	

TOTAL NUMBER OF SOFTWARE MODULES: 95

APPENDIX 3A

SOFTWARE MODULES AVAILABLE ON INTERNATIONAL MARKET
RESEARCH RESULTS

LEGEND: Activity No = 1 to 44; see Questionnaire form; Appendix 1A
Areas 1 & 2, underground mining, hard and soft rock respectively
Areas 3 & 4, surface mining, hard and soft rock respectively
Commercial Option XX : 1 = Yes, Blank = Not Specified

RUNNING COUNT	ACTIVITY NO	MODULE NAME	COMPANY NAME	OPT PURCHASE	OPT LEASE	APPLICATION AREA 1	APPLICATION AREA 2	APPLICATION AREA 3	APPLICATION AREA 4
1		dBASE III	ASHTON-TATE	1	1				
2		STATMAP	GANESA GROUP INTERNATIONAL LTD.	1	1	0	0	1	1
3		TERRAPLOT	TERRADATA	1	1	0	0	1	0
4		ASPEN PLUS	UNIVERSITY COMPUTING CO.	1	1				
5		C.P.S.	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
6	11	COAL G.I.S	BARBER, MABRY, CATO	1	1	0	1	0	1
7	11	MINL G.I.S	BARBER, MABRY, CATO	1	1	1	0	1	0
8	11	COAL G.I.S	GENERAL ELECTRIC	1	1	0	1	0	1
9	11	COAL G.I.S	GOLDER ASSOCIATES	1	1	0	1	0	1
10	11	MINL G.I.S	GENERAL ELECTRIC	1	1	1	0	1	0
11	11	MINL G.I.S	GOLDER ASSOCIATES	1	1	1	0	1	0
12	11	COAL G.I.S	ENERGY DATA SYSTEMS	1	1	0	1	0	1
13	11	COAL G.I.S	STSC	1	1	0	1	0	1
14	11	MINL G.I.S	ENERGY DATA SYSTEMS	1	1	1	0	1	0
15	11	F.M.S.	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
16	11	COAL G.I.S	COMPUSERVE	1	1	0	1	0	1
17	11	MINL G.I.S	STSC	1	1	1	0	1	0
18	11	MINL G.I.S	COMPUSERVE	1	1	1	0	1	0
19	11	COAL G.I.S	COMPUTER SCIENCES CORPORATION	1	1	0	1	0	1
20	11	COAL G.I.S	MATH TECH.	1	1	0	1	0	1
21	11	D-B-SYSTEM	HANNA MINING CO	1	1			1	1
22	11	GEOPAK	ERTEC,ROCKY MOUNTAIN, INC.	1	1			1	1
23	11	G.I.S.	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
24	11	D.B.M.S.	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
25	11	MINL G.I.S	MATH TECH.	1	1	1	0	1	0
26	11	COAL G.I.S	MORRISON-KNUDSEN	1	1	0	1	0	1
27	11	SIR/GEM	SCIENTIFIC INFO RETRIEVAL	1	1	0	0	1	1
28	11	G.D.S.	MINICOM PTY. LTD.	1	1	1	1	1	1
29	11	COAL G.I.S	GEOMIN COMPUTER SERVICES CORP.	1	1	0	1	0	1
30	11	MINL G.I.S	GEOMIN COMPUTER SERVICES CORP.	1	1	1	0	1	0
31	11	COAL G.I.S	KETRON	1	1	0	1	0	1
32	11	MINL G.I.S	KETRON	1	1	1	0	1	0
33	11	COAL G.I.S	ENERGY & MINERALS CONSULTANTS	1	1	0	1	0	1
34	11	MINL G.I.S	ENERGY & MINERALS CONSULTANTS	1	1	1	0	1	0
35	11	COAL G.I.S	CONTROL DATA CORPORATION	1	1	0	1	0	1
36	11	MINL G.I.S	CONTROL DATA CORPORATION	1	1	1	0	1	0
37	11	COAL G.I.S	INTERMOUNTAIN CONSUMER POWER	1	1	0	1	0	1
38	11	PCF	MINTEC,INC	1	1		1	1	1
39	11	MINL G.I.S	INTERMOUNTAIN CONSUMER POWER	1	1	1	0	1	0
40	12	GIS	COMPUSERVE	1	1			1	1
41	12	GEOCHEM	R.T.Z. CONSULTANTS LIMITED	1	1	1		1	
42	13	D.H.ANLYSS	R.T.Z. CONSULTANTS LIMITED	1	1	1		1	
43	13	D.H.D.E.	MINTEC,INC	1	1		1	1	1
44	13	GRADE EVLT	R.T.Z. CONSULTANTS LIMITED	1	1	1		1	
45	14	3D-GEO-MOD	CLIMAX MOLYBDENUM CO.	1	1	0	0	1	1
46	14	MINER II	GE INFORMATION SYSTEMS CO.	1	1	0	1	0	1

APPENDIX 3A

SOFTWARE MODULES AVAILABLE ON INTERNATIONAL MARKET
RESEARCH RESULTS

LEGEND: Activity No = 1 to 44, see Questionnaire form, Appendix 1A
Areas 1 & 2, underground mining, hard and soft rock respectively
Areas 3 & 4, surface mining, hard and soft rock respectively
Commercial Option XX : 1 = Yes, Blank = Not Specified

RUNNING COUNT	ACTIVITY NO	MODULE NAME	COMPANY NAME	OPT PURCHASE	OPT LEASE	APPLICATION AREA 1	APPLICATION AREA 2	APPLICATION AREA 3	APPLICATION AREA 4
47	14	MODEL-RSRV	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
48	14	D.T.M.	MARKHURD AERIAL SURVEYS, INC.	1	1	1	1	1	1
49	14	CPS-1/G	RADIAN CORPORATION	1	1	0	0	1	1
50	14	GRID-LIBRY	DYNAMIC GRAPHICS LTD.	1	1	0	0	1	1
51	14	INTRCT-MOD	DYNAMIC GRAPHICS LTD.	1	1	0	0	1	1
52	14	MNRL-INVNT	MINTEC,INC	1	1	0	0	1	1
53	14	GEO-DESGN	UNIVERSITY OF KENTUCKY	1	1		1	1	1
54	14	DYNMC-MODL	U.S. GEOLOGICAL SURVEY	1	1	0	1	0	1
55	15	Q-PLOT	COMPUSERVE	1	1	0	1	0	1
56	15	GRAPHICS	COMPUSERVE	1	1			1	1
57	15	CONTOUR	CALCOMP INC.	1	1			1	1
58	15	GPCP	CALCOMP INC.	1	1	1	1	1	1
59	15	THREE-D	CALCOMP INC.	1	1	1	1	1	1
60	15	GIS	GIBBS & HILL, INC.	1	1	1	1	1	1
61	15	GRFPAK	ERTEC,ROCKY MOUNTAIN, INC.	1	1	0	0	1	1
62	15	DIGITIZING	MORRISON KNUDSEN COMPANY, INC.	1	1			1	1
63	15	TOPOGRAPHY	PACSOFT	1	1	0	0	1	1
64	15	DISP-LIBRY	DYNAMIC GRAPHICS LTD.	1	1	0	0	1	1
65	15	CONTOURING	PRECISION VISUALS	1	1	0	0	1	1
66	16	STAT-ANLYS	HANNA MINING CO	1	1	1	1	1	1
67	17	COALSTAT	FLUOR ENGINEERS, INC.	1	1			1	1
68	17	GEOSTAT	KETRON,INC.	1	1	0	1	0	1
69	17	GEOLKRIG	PENNSYLVANIA STATE UNIVERSITY	1	1		1		
70	18	RESPAK	ERTEC,ROCKY MOUNTAIN, INC.	1	1	1	1	1	1
71	18	RESERVES	MORRISON KNUDSEN COMPANY, INC.	1	1			1	1
72	18	MATHMINE	MATH TECH.	1	1	0	0	1	1
73	18	SURVOL	MORRISON KNUDSEN COMPANY, INC.	1	1	1	1	1	1
74	18	GEOL	PENNSYLVANIA STATE UNIVERSITY	1	1	0	0	1	1
75	18	RES-COAL 2	VIRGINIA POLYTECHNIC INST. & STATE UNIVERSITY	1	1	1	1	1	1
76	18	STRIP	MINTEC,INC	1	1	0	1	0	1
77	18	RESERVES	MINTEC,INC	1	1		1	1	1
78	19	UG-DESIGN	INTRA SEARCH, INC.	1	1		1	1	1
79	19	MEDSYSTEM	COMPUSERVE	1	1	1	1	0	0
80	19	SURF-DESGN	SCICON	1	1			1	1
81	19	UG-LAYOUT	USBM MINING ENFORCEMENT & SAFETY ADM.	1	1	0	0	1	1
82	19	SURF-DESGN	GENERAL ELECTRIC	1	1	1	1	0	0
83	19	UG-DESGN	GENERAL ELECTRIC	1	1	0	0	1	1
84	19	SURF-DESGN	GOLDER ASSOCIATES	1	1	1	1	0	0
85	19	UG-DESGN	GOLDER ASSOCIATES	1	1	0	0	1	1
86	19	MINEPAK	ERTEC,ROCKY MOUNTAIN, INC.	1	1	1	1	0	0
87	19	SURF-DESGN	ENERGY DATA SYSTEMS	1	1			1	1
88	19	PITPAK	ERTEC,ROCKY MOUNTAIN, INC.	1	1	0	0	1	1
89	19	UG-DESGN	ENERGY DATA SYSTEMS	1	1			1	1
90	19	MINEBLK	MORRISON KNUDSEN COMPANY, INC.	1	1	1	1	0	0
91	19	SURF-DESGN	STSC	1	1	0	0	1	1

APPENDIX 3A

SOFTWARE MODULES AVAILABLE ON INTERNATIONAL MARKET
RESEARCH RESULTS

LEGEND: Activity No = 1 to 44, see Questionnaire form, Appendix 1A
Areas 1 & 2, underground mining, hard and soft rock respectively
Areas 3 & 4, surface mining, hard and soft rock respectively
Commercial Option XX : 1 = Yes, Blank = Not Specified

RUNNING COUNT	ACTIVITY NO	MODULE NAME	COMPANY NAME	OPT PURCHASE	OPT LEASE	APPLICATION AREA 1	APPLICATION AREA 2	APPLICATION AREA 3	APPLICATION AREA 4
92	19	UG-DESGN	STSC	1	1	1	1	0	0
93	19	FAST & SIM	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
94	19	ADAM	MICHAEL BAKER, JR., INC.	1	1	1	1	1	1
95	19	SURPASS	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
96	19	SURF-DESGN	COMPUSERVE	1	1	0	0	1	1
97	19	UG-DESGN	COMPUSERVE	1	1	1	1	0	0
98	19	SURF-DESGN	MATH TECH.	1	1	0	0	1	1
99	19	COMPUTASC	ENERGY DATA SERVICES	1	1				1
100	19	UG-DESGN	MORRISON-KNUDSEN	1	1	1	1	0	0
101	19	MINESIM	DATA-TECH INC.	1	1	1	1	1	1
102	19	PIT DESIGN	R.T.Z. CONSULTANTS LIMITED	1	1	1		1	
103	19	SURF-DESGN	GEOMIN COMPUTER SERVICES CORP.	1	1	0	0	1	1
104	19	UG-DESGN	GEOMIN COMPUTER SERVICES CORP.	1	1	1	1	0	0
105	19	SURF-DESGN	PSI INCORPORATED	1	1	0	0	1	1
106	19	UG-DESGN	PSI INCORPORATED	1	1	1	1	0	0
107	19	MAPPNG-PLN	COOPERS & LYBRAND SERVICES	1	1	0	0	1	1
108	19	SURF-DESGN	MONTANA STATE UNIVERSITY	1	1	0	0	0	1
109	19	SURF-DESGN	KETRON	1	1	0	0	1	1
110	19	UG-DESGN	KETRON	1	1	1	1	0	0
111	19	CMPP	SYSTEMS CONTROL, INC.	1	1	0	0	0	1
112	19	UG-DESGN	ENERGY & MINERALS CONSULTANTS	1	1	1	1	0	0
113	19	SURF-DESGN	ENERGY & MINERALS CONSULTANTS	1	1	0	0	1	1
114	19	MODEL&RSRV	HANNA MINING CO	1	1			1	1
115	19	SURF-DESGN	CONTROL DATA CORPORATION	1	1	0	0	1	1
116	19	CONTUR II	VIRGINIA POLYTECHNIC INST. & STATE UNIVERSITY	1	1	0	1	0	1
117	19	S/L.R.M.P.	HANNA MINING CO	1	1			1	1
118	19	UG-DESGN	CONTROL DATA CORPORATION	1	1	1	1	0	0
119	19	URANIUM-MM	BECHTEL CORPORATION	1	1	0	0	1	0
120	19	UG-DESGN	INTERMOUNTAIN CONSUMER POWER	1	1	1	1	0	0
121	19	DIPPER	MINTEC,INC	1	1		1	1	1
122	19	SURF-DESGN	INTRA SEARCH, INC.	1	1	0	0	1	1
123	19	SURF-DESGN	INTERMOUNTAIN CONSUMER POWER	1	1	0	0	1	1
124	20	STEPS	GENCOM	1	1			1	1
125	20	TECH-FIN-A	FLUOR UTAH INC.	1	1	0	0	1	1
126	20	MEDSYSTEM	MINTEC,INC	1	1		1	1	1
127	20	EVALUATION	MINE INFORMATION & PLANNING SYSTEMS	1	1	0	0	1	1
128	20	ECONOMIC A	HANNA MINING CO	1	1			1	1
129	21	OPTIMUM-P	ROAN CONSOLIDATED MINES LTD.	1	1	0	0	1	1
130	21	OPTIMUM-P	ASBESTOS INVESTMENTS (PTY) LTD.	1	1	0	0	1	1
131	21	OPTIMUM-P	CLEVELAND-CLIFFS IRON CO.	1	1	0	0	1	1
132	21	COPOR	FLUOR ENGINEERS, INC.	1	1	0	0	0	1
133	21	BOUNDARY	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
134	21	M.PLANNING	R.T.Z. CONSULTANTS LIMITED	1	1	1		1	
135	21	PIT-OPTMZN	HANNA MINING CO	1	1			1	1

APPENDIX 3A

SOFTWARE MODULES AVAILABLE ON INTERNATIONAL MARKET
RESEARCH RESULTS

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Areas 1 & 2, underground mining, hard and soft rock respectively
Areas 3 & 4, surface mining, hard and soft rock respectively
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RUNNING COUNT	ACTIVITY NO	MODULE NAME	COMPANY NAME	OPT PURCHASE	OPT LEASE	APPLICATION AREA 1	APPLICATION AREA 2	APPLICATION AREA 3	APPLICATION AREA 4
136	22	X-RAY-ANLS	RESEARCH CORPORATION	1	1	0	0	0	0
137	23	FRAGMENTN	USBM TWIN CITIES MINING RESEARCH CENTER	1	1	1	0	1	0
138	24	DSM	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
139	24	DPS	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
140	24	LHDSIM	VIRGINIA POLYTECHNIC INST. & STATE UNIVERSITY	1	1	1	1	0	0
141	24	LOAD/HAUL	VIRGINIA POLYTECHNIC INST. & STATE UNIVERSITY	1	1	0	1	0	0
142	25	PIPELINES	INDIAN SCHOOL OF MINES	1	1	1	1	1	1
143	25	MINEPACK	MATH TECH.	1	1	0	0	1	1
144	25	HAULSYN	MINING SERVICES, INC.	1	1	0	0	1	1
145	25	MHPIM	KETRON,INC.	1	1		1		1
146	25	VPIBELT	KETRON,INC.	1	1		1		1
147	25	MPASS/H	KETRON,INC.	1	1		1		
148	25	BELTSIM	VIRGINIA POLYTECHNIC INST. & STATE UNIVERSITY	1	1	1	1	0	0
149	25	TIRE-MAINT	HANNA MINING CO	1	1			1	1
150	25	FACTS-V	MINE DATA COMPUTER SERVICES,INC	1	1			1	1
151	27	EQ-SELECTN	INDIAN SCHOOL OF MINES	1	1	0	0	1	1
152	27	DRGL-SIMUL	UNIVERSITY OF QUEENSLAND	1	1	0	0	0	1
153	27	STRIP/COST	IOWA STATE UNIVERSITY	1	1	0	0	0	1
154	27	DRGL-SIMUL	AMAX COAL CO.	1	1	0	0	0	1
155	27	SMSS	BONNER AND MOORE	1	1	0	0	0	1
156	27	DSM	FLUOR ENGINEERS, INC.	1	1	0	0	0	1
157	27	PANEL MINR	FLUOR ENGINEERS, INC.	1	1	0	0	0	1
158	27	SMSS	GE INFORMATION SYSTEMS CO.	1	1	0	0	1	1
159	27	EQ/SIMULTN	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
160	27	PANEL MINE	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
161	27	MATHDRAG	MATH TECH.	1	1	0	0	0	1
162	27	SMRES	PENNSYLVANIA STATE UNIVERSITY	1	1	0	0	1	1
163	27	SNCALC	PENNSYLVANIA STATE UNIVERSITY	1	1	0	0	1	1
164	27	DRAGLINE	PENNSYLVANIA STATE UNIVERSITY	1	1	0	0	0	1
165	27	MULTI-M.PK	DATA-TECH INC.	1	1	1	1	1	1
166	27	PROD-MONIT	COSMIC	1	1	0	1	0	0
167	27	SIMULATES	R.T.Z. CONSULTANTS LIMITED	1	1	1		1	
168	27	DRGL-SIMUL	COLORADO SCHOOL OF MINES	1	1	0	0	0	1
169	27	UGMHS/K	KETRON,INC.	1	1		1		1
170	27	DRGL-SIMUL	PENNSYLVANIA STATE UNIVERSITY	1	1	0	0	1	1
171	27	MPASS-2.1	KETRON,INC.	1	1		1		
172	27	UG-EQUIP	PENNSYLVANIA STATE UNIVERSITY	1	1	0	0	1	1
173	27	MULTPIT-S	PENNSYLVANIA STATE UNIVERSITY	1	1	0	0	1	1
174	27	FACESIM IV	VIRGINIA POLYTECHNIC INST. & STATE UNIVERSITY	1	1	1	1	0	0
175	27	SIMULA-TRK	MIM HOLDINGS LTD.	1	1	0	0	1	1
176	27	COST RED'N	VIRGINIA POLYTECHNIC INST. &						

APPENDIX 3A

SOFTWARE MODULES AVAILABLE ON INTERNATIONAL MARKET
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RUNNING COUNT	ACTIVITY NO	MODULE NAME	COMPANY NAME	OPT PURCHASE	OPT LEASE	APPLICATION AREA 1	APPLICATION AREA 2	APPLICATION AREA 3	APPLICATIO AREA 4
177	27	UG-TRANSP	CHAMBER OF MINES OF SOUTH AFRICA	1	1	1	1	0	0
178	28	PRODREQ	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
179	28	CPMINE	KETRON,INC.	1	1		1		1
180	28	QUALITY	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
181	28	SEAMPLAN	MONTANA STATE UNIVERSITY	1	1	0	0	0	1
182	28	SCHEDULING	DIALOG PTY. LTD.	1	1	1	1	1	1
183	28	MOON	KETRON,INC.	1	1		1		
184	28	UG-3D/SCHD	NATIONAL COAL BOARD	1	1	0	1	0	0
185	28	PROD-SCHED	HANNA MINING CO	1	1			1	1
186	28	SCHEDULING	MINTEC,INC	1	1		1	1	1
187	30	UGMHS	PENNSYLVANIA STATE UNIVERSITY	1	1	0	1	0	0
188	31	EARTHWORK	MPS CO.	1	1	0	0	1	1
189	31	SURVEY A.	HANNA MINING CO	1	1			1	1
190	32	GROUND-MOV	INDIAN SCHOOL OF MINES	1	1	0	1	0	1
191	32	CANOPIES	USBM PITTSBURG TECHNICAL SUPPORT CENTER	1	1	0	1	0	0
192	32	STABL	PURDUE UNIVERSITY	1	1	0	0	1	1
193	32	LONGWALL	PENNSYLVANIA STATE UNIVERSITY	1	1	0	1	0	0
194	32	REAME	UNIVERSITY OF KENTUCKY	1	1	0	0	1	1
195	32	SWASE	UNIVERSITY OF KENTUCKY	1	1	0	0	1	1
196	32	ROOF SUPPT	PENNSYLVANIA STATE UNIVERSITY	1	1	0	1	0	0
197	32	LW-GROUND	VIRGINIA POLYTECHNIC INST. & STATE UNIVERSITY	1	1	0	1	0	0
198	32	LNGWSIM	VIRGINIA POLYTECHNIC INST. & STATE UNIVERSITY	1	1	1	1	0	0
199	33	MINE ROOF	MTS SYSTEMS CORP.	1	1	1	1	0	0
200	34	SCHEDVENT	BETHLEHEM STEEL CORP.	1	1	0	1	0	0
201	34	VENT/COST	AFRICAN ASSOCIATED MINES LTD.	1	1	1	1	0	0
202	34	VENT-SIMUL	MORRISON KNUDSEN COMPANY, INC.	1	1	1	1	1	1
203	34	MVAS	KETRON,INC.	1	1		1		1
204	34	VENTLTN	INCO MET. CO.	1	1	1	1	0	0
205	34	PSU/MVS	PENNSYLVANIA STATE UNIVERSITY	1	1	1	1	0	0
206	35	ILLUMINATN	USBM PITTSBURG MINING & SAFETY RES. CENTER	1	1	1	1	1	1
207	35	SUBSIDENCE	SCIENCE APPLICATIONS INC.	1	1	0	1	0	0
208	35	METHANE	USBM TECHNOLOGY TRANSFER	1	1	0	1	0	1
209	35	MINE-GAS	COLLEGE OF EASTERN UTAH	1	1	1	1	0	0
210	35	PERMITTING	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
211	35	MAGI	MATHEMATICAL APPLICATIONS GROUP, INC.	1	1	1	1	1	1
212	35	AIR Q.MODL	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
213	35	DIESEL	PENNSYLVANIA STATE UNIVERSITY	1	1	1	1	0	0
214	35	SUBSIDE	PENNSYLVANIA STATE UNIVERSITY	1	1	1	1	0	0
215	35	SUBSDNC-M	D'APPOLONIA CONSULTING ENG. INC.	1	1	0	1	0	0
216	35	HEALTH/SAF	PENNSYLVANIA STATE UNIVERSITY	1	1	0	0	1	1

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RUNNING COUNT	ACTIVITY NO	MODULE NAME	COMPANY NAME	OPT PURCHASE	OPT LEASE	APPLICATION AREA 1	APPLICATION AREA 2	APPLICATION AREA 3	APPLICATION AREA 4
217	35	SEEPAGE	UNIVERSITY OF IDAHO	1	1	0	0	1	1
218	35	MINSUBSIM	VIRGINIA POLYTECHNIC INST. & STATE UNIVERSITY	1	1	0	1	0	0
219	35	EVACUATION	FOSTER-MILLER ASSOC. INC.	1	1	1	1	0	0
220	36	H-EVASION	USBM MINING RESEARCH CENTER	1	1	1	1	0	0
221	36	PLAS-CANOP	USBM TECHNOLOGY TRANSFER	1	1	1	1	1	1
222	36	FIRE	FOSTER-MILLER ASSOCIATES	1	1	1	1	0	0
223	36	CLAIM II	MONTANA STATE UNIVERSITY	1	1	0	0	1	1
224	36	MODEL 522	SKELLY AND LOY	1	1	0	0	0	1
225	36	RECLA-MGM	SOUTHERN ILLINOIS UNIVERSITY	1	1	0	0	1	1
226	36	OPMHS	PENNSYLVANIA STATE UNIVERSITY	1	1	0	0	1	1
227	37	LEASE MGMT	BARBER, MABRY, CATO	1	1	1	1	1	1
228	37	LEASE MGMT	GENERAL ELECTRIC	1	1	1	1	1	1
229	37	LEASE MGMT	BONNER AND MOORE	1	1	1	1	1	1
230	37	LEASE MGMT	ENERGY DATA SYSTEMS	1	1	1	1	1	1
231	37	LEASE MGMT	COMPUTER SCIENCES CORPORATION	1	1	1	1	1	1
232	37	MINIE	KETRON,INC.	1	1		1		1
233	37	LEASE MGMT	MATH TECH.	1	1	1	1	1	1
234	37	NOVACOAL	STANDARD INSTRUMENTATION, INC.	1	1	0	1	0	1
235	37	LANDMGMT	SYSTEMS SPECIALIST	1	1	1	1	1	1
236	37	LEASE MGMT	INTERMOUNTAIN CONSUMER POWER	1	1	1	1	1	1
237	38	HYDROMODEL	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
238	38	METSIM	PINCOCK, ALLEN & HOLT, INC.	1	1	0	0	0	1
239	38	WATER	PENNSYLVANIA STATE UNIVERSITY	1	1	1	1	0	0
240	38	GWFAS	KETRON,INC.	1	1		1		1
241	38	FLEXMET	FLUOR MINING & METALS INC.	1	1	1	1	1	1
242	38	MICAM	KETRON,INC.	1	1		1		1
243	38	DRAINAGE-S	PENNSYLVANIA STATE UNIVERSITY	1	1	1	1	1	1
244	38	SEDIMOT II	UNIVERSITY OF KENTUCKY	1	1	0	0	1	1
245	38	POWER-S	PENNSYLVANIA STATE UNIVERSITY	1	1	0	0	0	1
246	38	SCHED IV	VIRGINIA POLYTECHNIC INST. & STATE UNIVERSITY	1	1	0	1	0	1
247	39	UG-FEAS	INTRA SEARCH, INC.	1	1	0	1	0	0
248	39	MINECO	COMPUSERVE	1	1			1	1
249	39	ECONMC-MOD	ICF INCORPORATED	1	1	1	1	1	1
250	39	ECONMC-MOD	BARBER, MABRY, CATO	1	1	1	1	1	1
251	39	ECONMC-MOD	GENERAL ELECTRIC	1	1	1	1	1	1
252	39	MINSIM	USBM TECHNOLOGY TRANSFER	1	1	1	1	1	1
253	39	SURF-FEAS	BONNER AND MOORE	1	1	0	0	0	1
254	39	MINECOST	ELECTRIC POWER RESEARCH INST.	1	1	1	1	1	1
255	39	ECONMC-MOD	ENERGY DATA SYSTEMS	1	1	1	1	1	1
256	39	CASHPAK	ERTEC,ROCKY MOUNTAIN, INC.	1	1			1	1
257	39	ECONMC-MOD	STSC	1	1	1	1	1	1
258	39	COCAM	JET PROPULSION LABORATORY	1	1	0	1	0	1
259	39	ECONMC-MOD	COMPUSERVE	1	1	1	1	1	1
260	39	ECONMC-MOD	COMPUTER SCIENCES CORPORATION	1	1	1	1	1	1
261	39	MINIE	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1

APPENDIX 3A

SOFTWARE MODULES AVAILABLE ON INTERNATIONAL MARKET
RESEARCH RESULTS

LEGEND: Activity No = 1 to 44, see Questionnaire form, Appendix 1A
Areas 1 & 2, underground mining, hard and soft rock respectively
Areas 3 & 4, surface mining, hard and soft rock respectively
Commercial Option XX : 1 = Yes, Blank = Not Specified

RUNNING COUNT	ACTIVITY NO	MODULE NAME	COMPANY NAME	OPT PURCHASE	OPT LEASE	APPLICATION AREA 1	APPLICATION AREA 2	APPLICATION AREA 3	APPLICATION AREA 4
262	39	SURF-FEAS	MATH TECH.	1	1	0	0	0	1
263	39	ECONMC-MOD	MATH TECH.	1	1	1	1	1	1
264	39	MINECOST	MUS CORP.	1	1	1	1	1	1
265	39	COST	PENNSYLVANIA STATE UNIVERSITY	1	1	1	1	1	1
266	39	SURF-FEAS	MORRISON-KNUDSEN	1	1	0	0	0	1
267	39	UG-FEAS	MORRISON-KNUDSEN	1	1	0	1	0	0
268	39	F.P.M.	R.T.Z. CONSULTANTS LIMITED	1	1	1		1	
269	39	SURF-FEAS	PSI INCORPORATED	1	1	0	0	0	1
270	39	UG-FEAS	PSI INCORPORATED	1	1	0	1	0	0
271	39	MPLAN	KETRON,INC.	1	1		1		1
272	39	PRD-ECONMC	SYSTEM TECHNOLOGY INC.	1	1	0	0	0	1
273	39	CAPPER	PENNSYLVANIA STATE UNIVERSITY	1	1	0	1	0	1
274	39	SURF-FEAS	ENERGY & MINERALS CONSULTANTS	1	1	0	0	0	1
275	39	ECONMC-MOD	ENERGY & MINERALS CONSULTANTS	1	1	1	1	1	1
276	39	ECONOMIC	SYSTEMS SPECIALIST	1	1	1	1	1	1
277	39	ECONMC-MOD	CONTROL DATA CORPORATION	1	1	1	1	1	1
278	39	RISK&SENS.	HANNA MINING CO	1	1			1	1
279	39	SURF-FEAS	INTERMOUNTAIN CONSUMER POWER	1	1	0	0	0	1
280	39	ECONMC-MOD	INTERMOUNTAIN CONSUMER POWER	1	1	1	1	1	1
281	39	UG-FEAS	INTERMOUNTAIN CONSUMER POWER	1	1	0	1	0	0
282	39	SURF-FEAS	INTRA SEARCH, INC.	1	1	0	0	0	1
283	39	FINANCIAL	MINTEC,INC	1	1		1	1	1
284	40	FINTE-ELEM	USBM SPOKANE MINING RESEARCH CENTER	1	1	1	1	1	1
285	40	BMINES	AGBADIAN ASSOCIATES	1	1	0	1	0	1
286	40	WDR	ARCH MINERAL CORP.	1	1	0	0	0	1
287	40	E.A & M.G.	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
288	40	STABL	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
289	40	FRACTURES	MORRISON KNUDSEN COMPANY, INC.	1	1	0	0	1	1
290	40	UG-RETREAT	UNIVERSITY OF UTAH	1	1	0	1	0	0
291	40	POLYCRYS-D	AUSTRALIAN NATIONAL UNIVERSITY	1	1	1	0	0	0
292	40	SLOPE STAB	STONE & WEBSTER ENG. CORP.	1	1	0	0	1	1
293	42	PMS	ASHAP ELECTRONICS LTD.	1	1	1	1	1	1
294	42	PDS	REL-TEK CORP.	1	1	1	1	1	1
295	43	COMPASS	BONNER AND MOORE	1	1	1	1	1	1
296	43	MAINTREC	MATH TECH.	1	1	1	1	1	1
297	43	MMASS	KETRON,INC.	1	1		1		1
298	44	OP-COSTS	DIALOG PTY. LTD.	1	1	1	1	1	1
299	44	MICA	ARGOS INC.	1	1	0	0	0	1
300	44	MCON	KETRON,INC.	1	1		1		1

APPENDIX 3B

SOFTWARE MODULES AVAILABLE ON INTERNATIONAL MARKET
RESEARCH RESULTS

LEGEND : Activity 1 to 44, see Questionnaire form, Appendix 1A

RUNNING COUNT	ACTIVITY NO	MODULE NAME	ABSTRACT
1		dBASE III	
2		STATMAP	
3		TERRAPLOT	
4		ASPEN PLUS	
5		C.P.S.	CONTOUR PLOTTING SYS/D.H.LOCATIONS,CONTOUR,XSECTIONS,BENCHES
6	11	COAL G.I.S	
7	11	MINL G.I.S	
8	11	COAL G.I.S	
9	11	COAL G.I.S	
10	11	MINL G.I.S	
11	11	MINL G.I.S	
12	11	COAL G.I.S	
13	11	COAL G.I.S	
14	11	MINL G.I.S	
15	11	F.M.S.	FORMS MANAGEMENT S.EDITS/UPDATES DBMS
16	11	COAL G.I.S	
17	11	MINL G.I.S	
18	11	MINL G.I.S	
19	11	COAL G.I.S	
20	11	COAL G.I.S	
21	11	D-B-SYSTEM	D.H,ROCKTYPES,TOPO,BLAST H/MACHINE PROCESSABLE
22	11	GEOPAK	GEOL-D.BASE-MANAGMNT/MANAGES&DISPLAY STRUCTURE TAILORED TO U
23	11	G.I.S.	GEO-INFORM-SYSTEM-ORGANIZE AND BUILD GEOLOGICAL-MODELS
24	11	D.B.M.S.	D.B. MANAGEMENT S.B.HOLE LOCATON,CORING LOGGING,ASSAYS
25	11	MINL G.I.S	
26	11	COAL G.I.S	
27	11	SIR/GEM	
28	11	G.D.S.	
29	11	COAL G.I.S	
30	11	MINL G.I.S	
31	11	COAL G.I.S	
32	11	MINL G.I.S	
33	11	COAL G.I.S	
34	11	MINL G.I.S	
35	11	COAL G.I.S	
36	11	MINL G.I.S	
37	11	COAL G.I.S	
38	11	PCF	PROJECT CONTROL FILE, PART OF MEDSYSTEM
39	11	MINL G.I.S	
40	12	GIS	GEOPHYSCL INTERPRTTN PROGR/GRAVITY&MAGNTC/I.P.&RESTVTY/+
41	12	GEOCHEM	2D GRIDS,ROLLING MEAN ANALYSIS,GENERAL/LOCAL GRID OPERTNS
42	13	B.H.ANLYSS	CALCULATES OPTIMUM MINING WIDTHS W. ASSAYS/WIDTHS,CUTOFF
43	13	D.H.D.E.	DRILL HOLE DATA ENTRY
44	13	GRADE EVLT	STATISTICAL RAPID&OBJECTIVE APPRAISSAL OF B.HOLE DRILLING
45	14	3D-GEO-MOD	
46	14	MINER II	
47	14	MODEL-RSRV	MODELING & RESERVES/POLYGON,1/XN,GEOSTAT,XSECTIONAL MODELING
48	14	D.T.M.	
49	14	CPS-1/6	
50	14	GRID-LIBRY	
51	14	INTRCT-MOD	

APPENDIX 3B
SOFTWARE MODULES AVAILABLE ON INTERNATIONAL MARKET
RESEARCH RESULTS
LEGEND : Activity 1 to 44, see Questionnaire form, Appendix 1A

RUNNING COUNT	ACTIVITY NO	MODULE NAME	ABSTRACT
52	14	MNRL-INVNT	REGULAR 3D/GRIDDED SEAM W.VRBL HEIGHT/VARIABLE BLOCK MODEL
53	14	GEO-DESGN	
54	14	DYNMC-MODL	
55	15	Q-PLOT	COMPREHENSIVE SYST FOR 3D DWG-SECTIONAL VIEWS
56	15	GRAPHICS	COMPREHENSIVE GRAPHICS CAPABILITIES
57	15	CONTOUR	
58	15	GPCP	
59	15	THREE-D	
60	15	GIS	
61	15	GRFPAK	SPECIAL SET OF TOOLS F.DISPLAY & CONTOUR D.B.VARIABLES
62	15	DIGITIZING	INPUT TOPO DATA,DIGITZNG,PLOT,CHECK,CORRECT MAPS,ANY SCALE
63	15	TOPOGRAPHY	
64	15	DISP-LIBRY	
65	15	CONTOURING	
66	16	STAT-ANLYS	CONVENTNL STAT-ANALYSIS,HISTOGRMS,SCATTERGRMS,VOLUME VS.GRAD
67	17	COALSTAT	
68	17	GEOSTAT	GEO-STATISTICAL ESTIMATION FOR BEDDED DEPOSITS
69	17	GEOLKRIG	
70	18	RESPAK	RESRVES ESTIMATON POLYGON,1/XN,KRIGING,ASSAY COMPOSITES
71	18	RESERVES	CUTOFF GRADE,MINIMUM THICKNESS,AREA INFLUENCE,BORDERS
72	18	MATHMINE	
73	18	SURVOL	VOLUMEN CALCULATIONS ON BLOCK MODEL SYST,OVERBURDEN,PRODUCTS
74	18	GEOL	
75	18	RES-COAL 2	
76	18	STRIP	SEQUENTIAL TECHNIQUES FOR RESERVES&INCREMENTAL PLANNING
77	18	RESERVES	GEOLOGCL RESERVES & RESERVES CONTAINED IN O/P OR U/G LIMITS
78	19	UG-DESIGN	
79	19	MEDSYSTEM	MINTEC PACKGE/D.B.MANGMT/GEOSTAT/COMPST/BLOCK M./PLANNING/+
80	19	SURF-DESGN	
81	19	UG-LAYOUT	
82	19	SURF-DESGN	
83	19	UG-DESGN	
84	19	SURF-DESGN	
85	19	UG-DESGN	
86	19	MINEPAK	SET INCLUDING-GEO/RES/PIT/GRF/CASH/PAK
87	19	SURF-DESGN	
88	19	PITPAK	OPEN P.-PROD-SCHEDULING,BLOCKS W.ASSAY&$ VALUES.COME MINER
89	19	UG-DESGN	
90	19	MINEBLK	MINING SCENARIO PROGRM,VARIES BENCHS,MATERIALS,DIMENSIONS
91	19	SURF-DESGN	
92	19	UG-DESGN	
93	19	FAST & SIM	
94	19	ADAM	
95	19	SURPASS	SURFACE M.PLANNING,ANALYSIS & SIMULATION SYST PACKGE
96	19	SURF-DESGN	
97	19	UG-DESGN	
98	19	SURF-DESGN	
99	19	COMPUTASC	INTERACTIVE EVALUATION SYST/D.B/RESERVES/CUT GENERATOR/+
100	19	UG-DESGN	
101	19	MINESIM	
102	19	PIT DESIGN	ITERATIVE FINAL PIT DESIGN W.SLOPES,MULTI BOTTOM PITS,PLOTS

RUNNING COUNT	ACTIVITY NO	MODULE NAME	ABSTRACT
103	19	SURF-DESGN	
104	19	UG-DESGN	
105	19	SURF-DESGN	
106	19	UG-DESGN	
107	19	MAPPNG-PLN	
108	19	SURF-DESGN	
109	19	SURF-DESGN	
110	19	UG-DESGN	
111	19	CMPP	
112	19	UG-DESGN	
113	19	SURF-DESGN	
114	19	MODEL&RSRV	MODELS W.GEOSTAT/CONVENTNL 1/XN,POLYG,TRIANG/GEO-CONTACTS/GR
115	19	SURF-DESGN	
116	19	CONTUR II	
117	19	S/L.R.M.P.	SHORT&LONG RANGE M.PLAN BY TRIAL&ERROR/PRODUCES MAPS,STATS,B
118	19	UG-DESGN	
119	19	URANIUM-MM	
120	19	UG-DESGN	
121	19	DIPPER	DYNAMIC,INTERACTIVE PIT PLANNING EVALUATOR,BLOCK MODEL,CONE
122	19	SURF-DESGN	
123	19	SURF-DESGN	
124	20	STEPS	SHORT TERM PLANNING&SCHED SYSTM/4 MODULES
125	20	TECH-FIN-A	
126	20	MEDSYSTEM	COMPLETE PACKAGE,EXPLORTN D.HANDLING/M.PLANNING/SCHED/FINANC
127	20	EVALUATION	
128	20	ECONOMIC A	ASSIGNS M.VALUE/BLOCK,REPORTS RESERVS/BENCH,NPV IFSCHED-AVAI
129	21	OPTIMUM-P	
130	21	OPTIMUM-P	
131	21	OPTIMUM-P	
132	21	COPOR	
133	21	BOUNDARY	GENERATES PIT ENDWALL CONFIGURATION,PLACE ROADS,BENCH,SLOPES
134	21	M.PLANNING	ITERATIVE M.P./CUTOFF/M.SEQUENCE/INTERIM PITS/PROD.RATES/M.P
135	21	PIT-OPTMZN	OPTM.ULTIMATE-PIT LIMITS W. ECONMCS,ROADS,GEOTCHNIA,LERCHS-G
136	22	X-RAY-ANLS	
137	23	FRAGMENTN	
138	24	DSM	DRGLINE SELECTION MODEL,4 PROGRAMS,264 D/L
139	24	DPS	DRAGLINE PROD-SIMLUATION/4PROGR/DEPOSITDESCRIP/SIMUL/ISO/PLO
140	24	LHDSIM	
141	24	LOAD/HAUL	
142	25	PIPELINES	
143	25	MINEPACK	
144	25	HAULSYM	
145	25	MMPIM	MINE HAULAGE PROD-IMPACT MODEL
146	25	VPIBELT	VPI BELT SIMULATOR
147	25	MPASS/M	GRAPH-DYNMC MINE HAULAGE SIMULATOR
148	25	BELTSIM	
149	25	TIRE-MAINT	TIRE MAINTENANCE REPORT W.SPECIFCTNS,MOVEMENTS,COSTS,HOURS
150	25	FACTS-V	ACCURATE CONTROL OF TIRE SYSTEM,TURN KEY-6 MONTHS PROGM,FINA
151	27	EQ-SELECTN	
152	27	DRGL-SIMUL	
153	27	STRIP/COST	

APPENDIX 3B
SOFTWARE MODULES AVAILABLE ON INTERNATIONAL MARKET
RESEARCH RESULTS
LEGEND : Activity 1 to 44, see Questionnaire form, Appendix 1A

RUNNING COUNT	ACTIVITY NO	MODULE NAME	ABSTRACT
154	27	DRGL-SIMUL	
155	27	SMSS	
156	27	DSM	
157	27	PANEL MINR	
158	27	SMSS	
159	27	EQ/SIMULTN	EQUIP/SIMULATION-PER PIECE OR PAIR,CAPACITY VS SCHED.COST
160	27	PANEL MINE	SIMULATION CALCULATES VOLUMES,QUALITY/USES COALSTATS KRIGING
161	27	MATHDRAG	
162	27	SMRES	
163	27	SMCALC	
164	27	DRAGLINE	
165	27	MULTI-M.PK	
166	27	PROD-MONIT	
167	27	SIMULATES	
168	27	DRGL-SIMUL	
169	27	UGMMS/K	PENN-STATE FACE PROD.MOD
170	27	DRGL-SIMUL	
171	27	MPASS-2.1	GRAPH_DYN FACE PROD_SIMULTN/R&P-SYSTMS/TIME STUDY/MAINT/STAT
172	27	UG-EQUIP	
173	27	MULTPIT-S	
174	27	FACESIM IV	
175	27	SIMULA-TRK	
176	27	COST RED'N	
177	27	UG-TRANSP	
178	28	PRODREQ	YEARLY MINE PROD TARGETS & M.PLAN TO MEET PROD.RATES/BENCH
179	28	CPMINE	CPM-L.TERM RELIAB/MAINT/FACE PROD.SYST/EVAL&REPORT RESULTS
180	28	QUALITY	BLENDING OPTIMIZATION/BENCHING CONFIGURTN,HEIGHT/WIDTHS
181	28	SEAMPLAN	
182	28	SCHEDULING	
183	28	MOOM	MINE QUALITY OPTMZTN MODEL/SEQUENCING MINIMIZE GRADE VARIATN
184	28	UG-3D/SCHD	
185	28	PROD-SCHED	SCHED.W.PRIORITIES,SLOPES,BLOCK PRECEDENCE,REDISTRIBUTES STR
186	28	SCHEDULING	MINE SCHEDULING PROGRMS,MAPS,CUT BY CUT,CUMULATIVE,PREPROD
187	30	UGMMS	
188	31	EARTHWORK	
189	31	SURVEY A.	SURVEY ANALYSIS,QUADRILATERAL ADJUSTMENT,TRIANGULATION
190	32	GROUND-MOV	
191	32	CANOPIES	
192	32	STABL	
193	32	LONGWALL	
194	32	REANE	
195	32	SWASE	
196	32	ROOF SUPPT	
197	32	LW-GROUND	
198	32	LNGWSIM	
199	33	MINE ROOF	
200	34	SCHEDIVENT	
201	34	VENT/COST	
202	34	VENT-SIMUL	SIMULATES DETAILES U/G VENTILATION SYST/MULTIPLE FANS,SHAFTS
203	34	MVAS	PENN-STATE VENTILATION MODEL
204	34	VENTLTN	

RUNNING COUNT	ACTIVITY NO	MODULE NAME	ABSTRACT
205	34	PSU/NVS	
206	35	ILLUMINATN	
207	35	SUBSIDENCE	
208	35	METHANE	
209	35	MINE-GAS	
210	35	PERMITTING	MODELS APPROVED BY EPA FOR SUBMISSIONS/GRAPHICS
211	35	MAGI	
212	35	AIR Q.MODL	EVALUATE IMPACT/VISIBILITY,DUST,RECLAMATION-MODELING
213	35	DIESEL	
214	35	SUBSIDE	
215	35	SUBSDNC-M	
216	35	HEALTH/SAF	
217	35	SEEPAGE	
218	35	MINSUBSIM	
219	35	EVACUATION	
220	36	M-EVASION	
221	36	PLAS-CANOP	
222	36	FIRE	
223	36	CLAIM II	
224	36	MODEL 522	
225	36	RECLA-MGM	
226	36	OPMHS	
227	37	LEASE MGMT	
228	37	LEASE MGMT	
229	37	LEASE MGMT	
230	37	LEASE MGMT	
231	37	LEASE MGMT	
232	37	MINIE	MINING ORIENTED INDUSTRIAL ENGR.DATA MANAGEMENT SYST
233	37	LEASE MGMT	
234	37	NOVACOAL	
235	37	LANDMGMT	
236	37	LEASE MGMT	
237	38	HYDROMODEL	HYDROMODELING PACKAGE,SURFACE HYDRO,FLOOD,GROUND,QUALITY
238	38	METSIM	
239	38	WATER	
240	38	GWFAS	GROUNDWATER FLOW ANALYSIS SYSTEM
241	38	FLEXNET	
242	38	MICAM	COST-MODEL,COST/TON,RETURN ON INVESTM/FINANC-DECISIONS
243	38	DRAINAGE-S	
244	38	SEDIMOT II	
245	38	POWER-S	
246	38	SCHED IV	
247	39	UG-FEAS	
248	39	MINECO	INCREMENTAL&TARGTNG SENSITVTY ANALYS/MAT.BAL/DEBT ANALYSIS/I
249	39	ECONMC-MOD	
250	39	ECONMC-MOD	
251	39	ECONMC-MOD	
252	39	MINSIM	
253	39	SURF-FEAS	
254	39	MINECOST	
255	39	ECONMC-MOD	

APPENDIX 3B
SOFTWARE MODULES AVAILABLE ON INTERNATIONAL MARKET
RESEARCH RESULTS
LEGEND : Activity 1 to 44, see Questionnaire form, Appendix 1A

RUNNING COUNT	ACTIVITY NO	MODULE NAME	ABSTRACT
256	39	CASHPAK	D.C.F.R.R.& N. P. V./MONTECARLO SIMULATONS
257	39	ECONMC-MOD	
258	39	COCAM	
259	39	ECONMC-MOD	
260	39	ECONMC-MOD	
261	39	MINIE	INV/EVALUATION/STANDS ALONE OR INTRCT W.SURPASS/PRODREQ
262	39	SURF-FEAS	
263	39	ECONMC-MOD	
264	39	MINECOST	
265	39	COST	
266	39	SURF-FEAS	
267	39	UG-FEAS	
268	39	F.P.M.	FINANC-PLANNG-MODEL,DRILLING TO FINAL PROD/MULTINAT.TAX,RISK
269	39	SURF-FEAS	
270	39	UG-FEAS	
271	39	MPLAN	PROD/FINANC-PLANNING SYST-EVAL/PLANS OVER MINE LIFE
272	39	PRD-ECONMC	
273	39	CAPPER	
274	39	SURF-FEAS	
275	39	ECONMC-MOD	
276	39	ECONOMIC	
277	39	ECONMC-MOD	
278	39	RISK&SENS.	RISK&SENSITIVITY ANALYSIS,PROBBLTY CURVE OF EXPECTED RETURN,
279	39	SURF-FEAS	
280	39	ECONMC-MOD	
281	39	UG-FEAS	
282	39	SURF-FEAS	
283	39	FINANCIAL	IRRI,NPV
284	40	FINTE-ELEM	
285	40	BMINES	
286	40	MDR	
287	40	E.A & M.G.	ELEMENT-ANALYS&MESH GENERTN/FINITE ELEMNT/GENERATE STRESS&DI
288	40	STABL	SLOPE STABILITY SOLUTION W.LIMIT EQUILIBRIUM METHOD,MONTECAR
289	40	FRACTURES	STEREOGRAMS FOR ANALYSIS,FRACTURES,SCHMIDT PLOTS W/W.O.TERZA
290	40	UG-RETREAT	
291	40	POLYCRYS-D	
292	40	SLOPE STAB	
293	42	PMS	
294	42	PDS	
295	43	COMPASS	
296	43	MAINTREC	
297	43	MMASS	MINE MAINTENANCE DATA ANALYSIS/STAT PROCESSING SYST
298	44	OP-COSTS	
299	44	MICA	
300	44	MCOM	COST MODEL/ALLOCATES CAPITAL,LABOR,OPERTN-COST/MINE LIFE

APPENDIX 3C
SOFTWARE MODULES WITH MARKETING OPTIONS

LEGEND: Activity No = 1 to 44, see Questionnaire form, Appendix 1A
Areas 1 & 2, underground mining, hard and soft rock respectively
Areas 3 & 4, surface mining, hard and soft rock respectively
Commercial Option XX : 1 = Yes, Blank = Not Specified

RUNNING COUNT	ACTIVITY NO	MODULE NAME	APPLICATION AREA 1	APPLICATION AREA 2	APPLICATION AREA 3	APPLICATION AREA 4	OPT PURCHASE	OPT LEASE	OPT TIME SHARE	OPT SERV BUREAU
1		RES.DE-MIN	1				1			
2		SEDIMOT-II					1		1	1
3	11	CADD/GEM3	1	1			1			
4	11	GEOMIN-3	1	1	1	1	1	1		1
5	11	IPF	1	1	1	1	1		1	1
6	11	MINEVAL V	1	1	1	1		1		1
7	11	MMVL-D.E.	1	1	1	1		1		
8	11	INP/OUTPUT	1	1	1	1	1	1		
9	11	FILEUTILTS	1	1	1	1	1	1		
10	11	SEAMSYS	1	1	1	1		1		1
11	11	SAMPTO	1	1				1		
12	11	QUEO IV	1	1	1	1	1	1	1	1
13	11	GEOLOG	1	1	1	1	1	1		1
14	11	G.D.M.	1	1	1	1		1	1	1
15	11	SYSTUTILTS	1	1	1	1	1	1		
16	11	MACROUTLTS	1	1	1	1	1	1		
17	11	SIR/DBMS1	1	1	1	1	1			
18	11	GEODAS		1		1	1			
19	11	LAMBDA DES	1	1	1	1	1	1	1	1
20	11	QUED IV	1	1	1	1	1	1	1	1
21	11	ANADAP-DB					1	1		
22	11	MINEX/BDS				1	1	1	1	1
23	11	GDM	1	1	1	1		1	1	
24	12	GRVTY-3D	0	0	1	1	1			1
25	12	GRVTY-2D	0	0	1	1	1			1
26	12	GRVTYPRISM	0	0	1	1	1			1
27	12	GEOCOR	1	1	1	1	1	1		1
28	12	MEGAS	1	1	1	1		1		1
29	12	GEOTPG	1	1	1	1	1	1		1
30	12	DPS-1	1		1		1	1		
31	12	XPLOR	1	1	1	1		1		
32	12	LOG/MATE	1	1					1	
33	12	GEOLOG		1		1	1			
34	12	QSTAT	1	1	1	1	1	1		
35	12	DSO	1	1	1	1		1		1
36	12	POLYSIM3	1	1	1	1	1	1	1	1
37	12	CPS-1	1	1	1	1	1	1		1
38	12	BDS1				1	1	1	1	1
39	13	GEOMIN-1	1	1	1	1	1	1		1
40	13	GEOMIN-2	1	1	1	1	1	1		1
41	13	BM/DATAMLS	1	1	1	1	1	1		
42	13	DISCODAT	1	1	1	1				1
43	13	BORDATA	1	1	1	1			1	1
44	13	BDS2				1	1	1	1	1
45	14	GMS				1	1	1	1	1
46	14	GEOMIN-4	1	1	1	1	1	1		1
47	14	GEOMIN-6	1	1	1	1	1	1		1
48	14	GEOMIN-5	1	1	1	1	1	1		1

APPENDIX 3C

SOFTWARE MODULES WITH MARKETING OPTIONS

LEGEND: Activity No = 1 to 44, see Questionnaire form, Appendix 1A
Areas 1 & 2, underground mining, hard and soft rock respectively
Areas 3 & 4, surface mining, hard and soft rock respectively
Commercial Option XX : 1 = Yes, Blank = Not Specified

RUNNING COUNT	ACTIVITY NO	MODULE NAME	APPLICATION AREA 1	APPLICATION AREA 2	APPLICATION AREA 3	APPLICATION AREA 4	OPT PURCHASE	OPT LEASE	OPT TIME SHARE	OPT SERV BUREAU
49	14	GEOMIN-7	1	1	1	1	1	1		1
50	14	MICROMODEL	1	1	1	1	1	1		
51	14	POLYGON			1	1		1		
52	14	URANIUM	1	1	1	1		1		1
53	14	MINTEC1			1	1		1	1	1
54	14	OREBODY-M	1	1	1	1	1	1		
55	14	GEOSTAT-P	1	1	1	1	1	1	1	1
56	14	GRIDDING	1	1	1	1		1	1	1
57	14	MINE-MODEL			1	1	1	1	1	1
58	14	MINER 2		1		1	1			
59	15	SHL-GIS	1	1	1	1	1	1		
60	15	3DGRAPHICS	1	1	1	1	1	1		1
61	15	MINTEC2			1	1		1	1	1
62	15	GDS	1	1	1	1	1	1	1	1
63	15	PLOTCALL	1	1	1	1	1			
64	15	SHL-RAMS			1	1	1	1		
65	15	CADD/GEM	1	1	1	1	1			
66	15	GDS	1	1	1	1	1	1	1	1
67	15	CPS-1	1	1	1	1			1	1
68	15	INTRACTGRA	1	1	1	1	1	1		
69	15	GRAPHICS	1	1	1	1	1	1		
70	15	POLYPAC	1	1	1	1	1	1	1	1
71	15	MAP3D	1	1	1	1	1	1	1	1
72	15	SIR/DBMS2	1	1	1	1	1			
73	15	PROFILES	1	1	1	1	1	1	1	1
74	15	GRAPHLIB	1	1	1	1		1	1	
75	15	X1	1	1	1	1	1			
76	16	GEOPLOT		1		1	1			
77	16	IMSL LIBRR						1	1	1
78	16	STAT/TRANS	1	1	1	1	1	1		
79	16	ESIS	1	1	1	1		1		1
80	16	SIR/DBMS3	1	1	1	1	1			
81	16	STATPROTRN						1	1	1
82	16	CADD/GEM2	1	1	1	1	1			
83	17	GEOSTATIST	1	1	1	1	1	1		
84	17	BLUEPACK3D		1		1		1	1	
85	17	GEOBASE	1	1	1	1		1		
86	18	GEOMIN-10	1	1	1	1	1	1		1
87	18	MRS				1	1	1	1	1
88	18	GEOMIN-8	1	1	1	1	1	1		1
89	18	GEOMIN-9	1	1	1	1	1	1		1
90	18	GEOMIN-11	1	1	1	1	1	1		1
91	18	MINTEC3			1	1		1	1	1
92	18	RCS	1	1	1	1	1	1		1
93	18	POLYGN	1	1	1	1	1	1	1	1
94	19	MSEAMS		1				1		
95	19	MINTEC4			1	1		1	1	1
96	19	PITPLAN			1	1		1	1	

APPENDIX 3C

SOFTWARE MODULES WITH MARKETING OPTIONS

LEGEND: Activity No = 1 to 44, see Questionnaire form, Appendix 1A
Areas 1 & 2, underground mining, hard and soft rock respectively
Areas 3 & 4, surface mining, hard and soft rock respectively
Commercial Option XX : 1 = Yes, Blank = Not Specified

RUNNING COUNT	ACTIVITY NO	MODULE NAME	APPLICATION AREA 1	APPLICATION AREA 2	APPLICATION AREA 3	APPLICATION AREA 4	OPT PURCHASE	OPT LEASE	OPT TIME SHARE	OPT SERV BUREAU
97	19	BESOL	1	1			1		1	
98	19	3D-MODLNG	1	1	1	1		1		
99	19	RD	1	1			1			
100	19	XPAC	1	1	1	1		1		1
101	19	STRIPSIM				1	1			
102	19	Q.U.-S1			1			1		
103	19	XPAC	1	1	1	1	1	1	1	1
104	19	MATHMINE1				1	1	1		
105	19	CSD/SMP			1	1		1		1
106	19	MOR-ISD1	1		1					1
107	19	PIT-DESIGN	1	1	1	1	1	1		
108	19	XPAC	1	1	1	1	1	1	1	1
109	19	XPAC	1	1	1	1	1	1	1	1
110	19	BMINES-1	1	1			1			
111	20	MINECAN	1	1	1	1			1	1
112	20	MINTEC5			1	1		1	1	1
113	20	EVA	1	1	1	1	1	1		
114	20	EVAL 5	1	1	1	1			1	1
115	20	FIPAC 5	1	1	1	1			1	1
116	20	IFPS	1	1	1	1	1		1	1
117	20	MINECOST		1		1	1			
118	21	MINTEC6			1	1		1	1	1
119	21	CPS-1	1	1	1	1	1	1	1	1
120	21	POS	0	0	1	1	1	1		1
121	21	FCONE			1	1		1		1
122	21	MULTIPIT			1	1		1		
123	22	ISHAPS	1	1			1			
124	22	PREMINI	1	1	1	1		1	1	1
125	22	LAB EQP AU	1	1	1	1	1			
126	22	MATHPROTRN						1	1	1
127	23	MINETICS					1	1		
128	24	EVENT-CONV	1		1		1	1	1	1
129	24	CONVEYOR-M	1		1		1	1	1	1
130	24	MSS	1			1	1	1	1	1
131	24	X2					1	1		
132	24	TALPAC		1		1	1	1	1	1
133	25	T/SEWTBSD			1	1	1			
134	25	T/S-MATH/M			1	1	1			
135	25	MSS-TRUCK	1			1	1	1	1	1
136	25	X3					1	1		
137	25	TALPAC			1	1	1	1	1	1
138	25	SIMP		1		1		1		
139	25	TAS-II			1	1	1			
140	26	X4					1	1		
141	27	BIN/HOPPER	1		1		1	1	1	1
142	27	B/L-MATH/M				1	1			
143	27	MSS-B/L	1			1	1	1	1	1
144	27	BEDMIN-12	1	1	1	1	1	1		1

APPENDIX 3C

SOFTWARE MODULES WITH MARKETING OPTIONS

LEGEND: Activity No = 1 to 44, see Questionnaire form, Appendix 1A
Areas 1 & 2, underground mining, hard and soft rock respectively
Areas 3 & 4, surface mining, hard and soft rock respectively
Commercial Option XX : 1 = Yes, Blank = Not Specified

RUNNING COUNT	ACTIVITY NO	MODULE NAME	APPLICATION AREA 1	APPLICATION AREA 2	APPLICATION AREA 3	APPLICATION AREA 4	OPT PURCHASE	OPT LEASE	OPT TIME SHARE	OPT SERV BUREAU
145	27	DETSIM	1	1	1	1	1			1
146	27	PITSIM	1	1	1	1	1			1
147	27	SIMSOUT	1	1			1			1
148	27	X5					1	1		
149	27	PITSIM-II			1			1		
150	27	DRGSIM			1	1	1	1	1	1
151	27	D/LEVNTBSD				1	1	1	1	1
152	27	B/W-MODEL			1		1	1	1	1
153	27	SIMP-2		1		1	1			
154	27	'DRAG'				1	1			
155	27	MATHMINE2				1	1	1		
156	28	GEOMIN-13	1	1	1	1	1	1		1
157	28	MATHMINE3				1	1	1		
158	29	GEOPRD	1	1	1	1	1	1		1
159	29	X6					1	1		
160	30	X7					1	1		
161	31	BLASTHOLE	1				1			
162	31	BLENDING	1	1	1	1		1	1	
163	31	CLAIMIIGRD			1	1	1	1	1	
164	31	GROMOD	1	1	1	1		1		1
165	32	ROCMEC	1		1					1
166	32	SLOPE II		1		1				1
167	32	X8					1	1		
168	32	BMINES-2	1	1			1			
169	33	BMINES-3	1	1			1			
170	34	MIVENDES	1	1				1		1
171	34	PSUMVS	1	1						1
172	34	GEOVNT	1	1	1	1	1	1		1
173	34	X9					1	1		
174	34	M.M.V.S.	1					1		
175	35	GRNDWATER	1	1	1	1	1	1		1
176	35	X10					1	1		
177	35	OCC-EXPSR					1			
178	35	WIND SYS			1	1	1			
179	35	WQ SYS			1	1	1			
180	35	CLAIMIIFEA			1	1	1	1	1	
181	35	AQ SYS			1	1	1			
182	37	M-MGNER/30					1	1		
183	37	MATHMINE4				1	1	1		
184	37	X1	1	1	1	1	1			
185	38	X11					1	1		
186	38	COOL		1		1			1	
187	38	ASPENPLUS1			1	1	1	1	1	1
188	38	MATHMINE5				1	1	1		
189	38	DIGIT/AREA	1	1	1	1		1		
190	38	EXTRACTIVE	1	1	1	1		1		
191	38	X2	1	1	1	1	1			
192	39	MINCOST	1	1	1	1			1	1

APPENDIX 3C

SOFTWARE MODULES WITH MARKETING OPTIONS

LEGEND: Activity No = 1 to 44, see Questionnaire Form, Appendix 1A
Areas 1 & 2, underground mining, hard and soft rock respectively
Areas 3 & 4, surface mining, hard and soft rock respectively
Commercial Option XX : 1 = Yes, Blank = Not Specified

RUNNING COUNT	ACTIVITY NO	MODULE NAME	APPLICATION AREA 1	APPLICATION AREA 2	APPLICATION AREA 3	APPLICATION AREA 4	OPT PURCHASE	OPT LEASE	OPT TIME SHARE	OPT SERV BUREAU
193	39	GEOFIN	1	1	1	1	1	1		1
194	39	OPCOST	1	1	1	1	1			
195	39	FISCAL	1	1	1	1	1			
196	39	MATHMINE6				1	1	1		
197	39	CLAIMIITCN			1	1	1	1	1	
198	39	ASPENPLUS2			1	1	1	1	1	1
199	40	GEOMEC	1	1	1	1	1			
200	40	GEOTCHNICS	1	1	1	1	1	1		1
201	40	BOUDEM_DIS	1	1	1	1	1			
202	40	ROCKMECHCS	1	1	1	1	1	1		1
203	40	SAP2D77	1				1			
204	40	MINTAB	1	1						1
205	40	GEOTEC/LOG	1	1	1	1	1	1		
206	40	X3	1	1	1	1	1			
207	41	X12					1	1		
208	42	X13					1	1		
209	42	PERSONNEL	1				1			
210	42	ANADAP-PER					1	1		
211	42	SIR/DBMS4	1	1	1	1	1			
212	43	GEOMNT	1	1	1	1	1	1		1
213	43	MITIS	1	1	1	1				1
214	43	GEOTRK	1	1	1	1	1	1		1
215	43	MPSS					1			
216	43	X14					1	1		
217	43	MAINTENNCE	1	1	1	1	1			
218	43	CYBERGEM	1	1	1	1		1		1
219	44	MCBUD	1	1	1	1		1		1
220	44	MINPAY	1	1	1	1	1			
221	44	MINMS	1	1	1	1	1			
222	44	MICA/ABECA	1	1	1	1	1	1		
223	44	SUPPLY	1	1	1	1	1			
TOTAL :			140	138	152	172	164	151	066	109

APPENDIX 3D
SOFTWARE MODULES WITH MARKETING OPTIONS
QUESTIONNAIRE RESULTS
LEGEND : Activity 1 to 44 ,see Questionnaire form, Appendix 1A

RUNNING COUNT	ACTIVITY NO	MODULE NAME	ABSTRACT	COMPANY NAME
1		RES.DE-MIN	ENREGISTREMENT ET CALCUL DES RESERVES DE MINERAI	NOTHGATE PATINO MINES INC.
2		SEDIMOT-II		UNIVERSITY OF KENTUCKY,INSTITUTE OF MINING AND MINERALS RES.
3	11	CADD/GEM3	CODING&ANALYSS OF D.H.DATA,DETECTS CODNG ERRORS,BATCH	MINING RESEARCH LABORATORIES/CANMET/E.M.&R,CANADA
4	11	GEOMIN-3	EXPLOR-INFO DATMANAGMNT-DHOLE,MAP&ISOPACH-SOURCES	GEOMIN COMPUTER SERVICES CORP
5	11	IPF	RELATIONAL D.M.SYS.UPDATES,QUERY,REFORTING,D.TRANSFORMTN	CONTROL DATA CORPORATION
6	11	MINEVAL V	MINERAL EVALUATION SYSTEM.MODEL DEPOSITS,CALCLTS RESRVES	CONTROL DATA CORPORATION
7	11	MNVL-D.E.	BUILDS D.B.OF INFORMTON THEN USED BY MINEVAL V MODLNG SYSTM	CONTROL DATA CORPORATION
8	11	INP/OUTPUT	A RANGE OF IN/OUTPUT PROCESSES FOR <DATAMINE>SYST	MINERAL INDUSTRIES COMPUTING LIMITED
9	11	FILEUTILTS	DATHANDLIG PROC-W-RELTHAL DBASE CAPBLTY&GEN DHANDLING	MINERAL INDUSTRIES COMPUTING LIMITED
10	11	SEAMSYS	SEAM EVLUATN SYSTEM,BUILDS MODEL,CALCLTS RESRVES,ETC	CONTROL DATA CORPORATION
11	11	SAMPTO	STRESS ANAL FOR MINE PLANNING TUBULAR OREBODIES	CONTROL DATA CORPORATION
12	11	QUEO IV	DATBASE SYST MANIPULTS GEODAT,QUALTY,ANALYSS,PRODCTN DAT&COS	MRSTON&MARSTON,INC
13	11	GEOLOG	CMPRHENSV S/W/PKG CAPTURES,PROCESSNG&DISPLY GEODATA	INTERNATIONAL GEOSYSTEM CORPORATION
14	11	G.D.H.	GRAL.D.HANDLING-TRANSLATION,ROTATION,GRADE CUTOFF,GEOSTAT	H.A. SIMONS (INTERNATIONAL) LTD.
15	11	SYSTUTILTS	AUXPRG FOR LOGON/LOGOFF ENVIRONMENT/BACKUP/HELP	MINERAL INDUSTRIES COMPUTING LIMITED
16	11	MACROUTLTS	ALLOWS PSEUDO-BATCH OPERATION OF DATAMINE	MINERAL INDUSTRIES COMPUTING LIMITED
17	11	SIR/DBMS1	SEE PAMPHLET	S.I.R. INC.
18	11	GEODAS	DATA MANGMNT SYSTM-GEOLOG&ANALYTICAL DATA	NINCON PTY LTD
19	11	LAMBDA DES	EXPLORATION,MINE DESIGN,DEVELOPMENT	SNC.INC-MINING&METALLURGY DIV.
20	11	QUED IV	DATBASE SYSTM FOR GEODATA,GRADE ANALYSS,PRODCTNDAT&COST	THE UNA GROUP
21	11	ANADAP-DB	SEE PAMPHLET	ANALYTICAL DATA PROCESSING
22	11	MINEX/BDS	COMPREHENSIVE SYSTM-W-SSUBS/BOREHOLE D.B.&PLOTTNG	EXPLORATION COMPUTER SERVICES INC.
23	11	GDM	GEOLOGICAL DATA-MANAGEMENT SYSTEM	GEOMATH INC.
24	12	GRVTY-3D	GRAVTNL EFFCT OF 3DMSNL BODIES OF ARBTRRY SHAPE	EARTH PHYSICS BRANCH,ENERGY MINES & RESOURCES,CANADA
25	12	GRVTY-2D	GRAVITAIONAL EFFECT OF 2DIMNSNL BODIES OF ARBITRARY SHAPE	EARTH PHYSICS BRANCH,ENERGY MINES & RESOURCES,CANADA
26	12	GRVTYPRISM	GRAVITATIONAL ATTRACTION OF A RIGHT RECTANGULAR PRISM	EARTH PHYSICS BRANCH,ENERGY MINES & RESOURCES,CANADA
27	12	GEOCOR	GRAPH DISPLY&ANALYSIS/CORELOG,GEOPHYSICS&QUALITY GRADE INFO	GEOMIN COMPUTER SERVICES CORP
28	12	MEGAS	GEOCHEMICAL ANALYSIS	CONTROL DATA CORPORATION
29	12	GEOTPG	SURFACE RELATED-INFO/DATAMANGMT/DISPLAY&ANALYSIS	GEOMIN COMPUTER SERVICES CORP
30	12	DPS-1	DEVELOPED A SYSTEM/GEOCH-D.ENTRY-PROCSSNG-PLOTTING/LTD.RUNS	DATAPLOTTING SERVICES
31	12	XPLOR	PROVIDES AUTOMATIC PROCESSING OF DIGITAL IMAGERY	CONTROL DATA CORPORATION
32	12	LOG/MATE	ANALYSE WELL LOGS FOR EXPLORATION EVALUATION	LOG/MATE LIMITED
33	12	GEOLOG	DISPLAY AND MANIPULATION OF DOWNHOLE GEOPHYSICAL LOGS	NINCON PTY LTD
34	12	QSTAT	DATA MANIPULATION-STAT.ANALYSIS	SNC.INC-MINING&METALLURGY DIV.
35	12	DSO	OPTINIZES DRILLHOLE SITE SELECTION	CONTROL DATA CORPORATION
36	12	POLYSIM3	STOCHASTIC SIMLTN OF GRADEDATA/MINEPLANNGN-GRDE CONTROL	GEOSTAT SYSTEMS INTERNATIONAL INC.

RUNNING COUNT	ACTIVITY NO	MODULE NAME	ABSTRACT	COMPANY NAME
37	12	CPS-1	GEOLOGCL MODELLING TOOL-3D CONSTRCTN GEO STRUCTRS-ACCURATE	THE UMA GROUP
38	12	BDS1	INPUTS/SURVEY-LITHOLGY-GEOCHEM-GEOPHYS/FLEXBL REPRTNG-PLOTTN	EXPLORATION COMPUTER SERVICES INC.
39	13	GEOMIN-1	DATA ANALYSIS-STAT-GEOSTAT OF EXPLOR INFO	GEOMIN COMPUTER SERVICES CORP
40	13	GEOMIN-2	PLAN,SECTION&D-HOLE DISPLAY OF EXPLOR-INFO	GEOMIN COMPUTER SERVICES CORP
41	13	DH/DATANLS	DRILHOLE SURVEY DAT&COMPOSITING SAMPLE DAT PROC PROGRMS	MINERAL INDUSTRIES COMPUTING LIMITED
42	13	DISCODAT	GESTION DES DONNEES SUR LES DISCONTINUITELS DU MASSIF ROCHEU	UNIVERSITE LAVAL,DEPT.MINES ET METALLURGIE
43	13	BORDATA	B.HOLE D.VERTCL ONLY,CUSTOMZD LITHLGY,FLXBL INPT FORMATS	CONTROL DATA CORPORATION
44	13	BDS2	DETAILD LITHLGCL LOGS&WASHOLTY REPRTS/SECTIONS-CONTOUR-ISOPA	EXPLORATION COMPUTER SERVICES INC.
45	14	GMS	MODELS SEAM OR WORKING SECTION-FAULTS-WASHOUTS/MAPS STRP R.	EXPLORATION COMPUTER SERVICES INC.
46	14	GEOMIN-4	GRIDDED GEOLOG-MODELLING OF TABULAR-MULTISEAM DEPOSITS	GEOMIN COMPUTER SERVICES CORP
47	14	GEOMIN-6	POLYGONAL GEOLOG MODELLING OF DISEMINATED OREBODIES	GEOMIN COMPUTER SERVICES CORP
48	14	GEOMIN-5	SECT.GEOL.MODEL OF COMPLEX ORE&GEOL FORMATION	GEOMIN COMPUTER SERVICES CORP
49	14	GEOMIN-7	3-D BLOCK GEOLOGICAL MODELLING OF OREBODIES	GEOMIN COMPUTER SERVICES CORP
50	14	MICROMODEL	COMPLETE MODELLING,MINE PLANNING SYSTEM	PINCOCK,ALLEN & HOLT,INC.
51	14	POLYGON	QUICK RESERVES ESTIMATES USING POLYGONS	CONTROL DATA CORPORATION
52	14	URANIUM	ASSISTS IN MODELLING URANIUM ORE BODIES	CONTROL DATA CORPORATION
53	14	MINTEC1	MINE PLANNING & DESIGN	COMPUTER SCIENCE CORP.
54	14	OREBODY-M	OREBODY&MULTISEAM MODELHANDLING USING MODFD BLOCK STRUCTURE	MINERAL INDUSTRIES COMPUTING LIMITED
55	14	GEOSTAT-P	3D-GEOT-OBODYMODELGN-COMPOSITN/VARIOG/KRIG/RESERVES/PLOTS	GEOSTAT SYSTEMS INTERNATIONAL INC.
56	14	GRIDDING	HAR&BIHARMNIC G.REFINEMENT,G.OPERATIONS,SECTIONS,3D,CONTOURS	H.A. SIMONS (INTERNATIONAL) LTD.
57	14	MINE-MODEL	BLOCK MODEL GEOLOGICAL/MINEABLE RESERVES,REPORTS,SECTIONS	H.A. SIMONS (INTERNATIONAL) LTD.
58	14	MINER 2	MODELLING SEDDEPOSITS-ISOPACMPLAN,SECTNS,RESERVS ESTMTES	MINCOM PTY LTD
59	15	SHL-GIS	GENERAL PURPOSE MAPPING,EARTH RESOURCE ANLYSIS&GEOGR INFO	SHI GRAPHIC SYSTEM LTD
60	15	3DGRAPHICS	GENERAL PURPOSE 3-D GRAPHICS DISPLAY	GEOMIN COMPUTER SERVICES CORP
61	15	MINTEC2	MINE PLANNING & DESIGN	COMPUTER SCIENCE CORP.
62	15	GDS	GENRL DRFTNG SYSTM-LAYOUTS,MAPS,DESIGN,EQUIPMNT RPRSNTTN	THE UMA GROUP
63	15	PLOTCALL	CONTOUR GENERTN&DISPLAY,3D PERSPECTV-GRAPHS&CHARTS	CONTROL DATA CORPORATION
64	15	SHL-RAMS	GENERAL-PURPOSE MAPPING,FACILITIES MANGMNT AND INVNTRY SYST	SHI GRAPHIC SYSTEM LTD
65	15	CADD/GEM	PRGRM GEM3000,PLOTS DH PROJCTNS 2D,GRADES PROFLS,ECONMCL INT	MINING RESEARCH LABORATORIES/CANMET/E.M.&R,CANADA
66	15	GDS	GRL DRAFTNG SYST-MINE LAYOUT,MAPS,PERMITS,MINE DESIGN,EQUIPM	MARSTON&MARSTON,INC
67	15	CPS-1	GNRL PURPOSE CONTOURNG PACK,FAULTING,PERSPECTIVES	CONTROL DATA CORPORATION
68	15	INTRACTGRA	CONTRL DIGTZN&INTRACT-W-DBASE PARTCURLY OREBODY-M-FILES	MINERAL INDUSTRIES COMPUTING LIMITED
69	15	GRAPHICS	GENPURPSE GRAPHICS PROGRMS+SPECIFICS FOR SECTIONS PLOTS	MINERAL INDUSTRIES COMPUTING LIMITED
70	15	POLYPAC	GRIDGN-W-UNIVKRGN&GEN-COVAR/CONTOUR-BICUBC-SPLINE	GEOSTAT SYSTEMS INTERNATIONAL INC.
71	15	MAP3D	ED VIEW OF ANY 2D DATA WITH HIDDEN LINE ALGO	GEOSTAT SYSTEMS INTERNATIONAL INC.
72	15	SIR/DBMS2	SEE PAMPHLET	S.I.R. INC.

RUNNING COUNT	ACTIVITY NO	MODULE NAME	ABSTRACT	COMPANY NAME
73	15	PROFILES	GENERTES MULTIPLE XSECTIONS SURFACE PROFILES	M.A. SIMONS (INTERNATIONAL) LTD.
74	15	GRAPHLIB	GENRAL GRAPHSOFTW FOR GEODATA/DHOLES-MODELS	GEOMATH INC.
75	15	X1	PLTS COLOR ISOCRVS USING BICUBCSPLINE METHD,POINT -BLOCK	MINING RESEARCH LABORATORIES/CANMET/E.M.&R,CANADA
76	16	GEOPLOT	GENERALIZED PLOTTNG&STATS OF 3-D DATA	MINCOM PTY LTD
77	16	IMSL LIBRR	540 MATHEMATICAL AND STATISTICAL SUBROUTINES	IMSL,SALES DIV.
78	16	STAT/TRANS	STATIST APPLCTN&NUMERCAL TRANSFORMTN OF DATA PROGRMS	MINERAL INDUSTRIES COMPUTING LIMITED
79	16	ESIS	GEOCHEMICAL ANALYSIS,STATISTICS	CONTROL DATA CORPORATION
80	16	SIR/DBMS3	SEE PAMPHLET	S.I.R. INC.
81	16	STATPROTRN	PROBLM SOLVNG SYSTM FOR STATISTICS	IMSL,SALES DIV.
82	16	CADD/GEM2	STATISTICS,GEOSTATCL EVALUATION OF MINES<GEM>ONLY IN C730	MINING RESEARCH LABORATORIES/CANMET/E.M.&R,CANADA
83	17	GEOSTATIST	COMPUTATION OF 2D-3D VARIOGRAMS DOWNHOLE AND DIRECTIONAL	MINERAL INDUSTRIES COMPUTING LIMITED
84	17	BLUEPACK3D	GENERAL STATISTICAL PACKAGE FOR LAYER TYPEDEPOSITS	GEOMATH INC.
85	17	GEOBASE	LINEAR GEOSTAT ADAPTED FOR SMALL MICRO COMPUT	GEOMATH INC.
86	18	GEOMIN-10	SECTIONAL DESIGN OF UNDERGROUND MINING OPERTN	GEOMIN COMPUTER SERVICES CORP
87	18	MRS	MODELS SEAM OR WORKING SECTION-FAULTS-WASHOUTS/MAPS STRP R.-	EXPLORATION COMPUTER SERVICES INC.
88	18	GEOMIN-8	GRIDDED PLAN DESIGN OF SURFACE MINING OPERATIONS	GEOMIN COMPUTER SERVICES CORP
89	18	GEOMIN-9	GRIDDED PLAN DESIGN OF STRIP MINING OPERATIONS	GEOMIN COMPUTER SERVICES CORP
90	18	GEOMIN-11	SECTIONAL DESIGN OF SURFACE MINING OPERATONS	GEOMIN COMPUTER SERVICES CORP
91	18	MINTEC3	MINE PLANNING & DESIGN	COMPUTER SCIENCE CORP.
92	18	RCS	CMPREHENSV S/W PKG OREBODY MODLLNG&GRADETONNGE CALCLTN	INTERNATIONAL GEOSYSTEM CORPORATION
93	18	POLYGN	POLYGNAL ORESEVE ESTIMTN DISPLAYS POLYGN ON PLOTTER	GEOSTAT SYSTEMS INTERNATIONAL INC.
94	19	MSEAMS	CALCLTS DISPLACEMNTS STRAIN&STRESSES U/G MULTIPLE SEAMS	CONTROL DATA CORPORATION
95	19	MINTEC4	MINE PLANNING & DESIGN	COMPUTER SCIENCE CORP.
96	19	PITPLAN	PORDUCES POD SCHED&TRUCK REQUIERMNTS BY SIMULATION	CONTROL DATA CORPORATION
97	19	BESOL	2D AND 3D MODELLING OF LOADS ON MINE PILLARS	CONTROL DATA CORPORATION
98	19	3D-MODLNG	INTRCTV GRAPHIC SYST FOR OREBODY MODELLING&MINE DESIGN	CONTROL DATA CORPORATION
99	19	RD	LAYOUT&DESGN OF RAMPS AND MINE DEVELOPMENT	CENTRE DE RECHERCHE NORANDA
100	19	XPAC	SCHEDULES MINE PRODUCTION	CONTROL DATA CORPORATION
101	19	STRIPSIM	STRIP MINE SIMULATOR	PINCOCK,ALLEN & HOLT,INC.
102	19	Q.U.-S1	COMPREHENSIVE O.P.DESIGN SYSTEM DEVLPD W. Q-CARTIER,9 SUBSYS	QUEENS-U.
103	19	XPAC	EXCAVATION PLANNING&SCHED-PROD.SCHED/BROADBRUSH&DETAIL	MINING SOFTWARE ASSOCIATES
104	19	MATHMINE1	SEE PAMPHLET	MARTIN MARIETTA DATA SYSTEMS
105	19	CSD/SMP	ASSISTS DESIGNS OF X SECTIONS&STRIP MINE PLANNING	CONTROL DATA CORPORATION
106	19	NOR-ISD1	COMPLETE MINE PLANNING SOFTW/IN HOUSE DEVLPD	NORANDA MINES LTD. INFORMATION SYST.DIV
107	19	PIT-DESIGN	OPENPIT DESGN PROGRM USING INTRACTV GRAPHICS INC	MINERAL INDUSTRIES COMPUTING LIMITED
108	19	XPAC	M-PLNNGN&SCHDLNG,USES GEOMODL DAT,PHYSCL M-CNTRNS,EQUIP PARM	MRSTON&MARSTON,INC
109	19	XPAC	MINE PLAN&SCHED-W-GEOMODLDAT,EQUIPPARMTRS,PHYSCL DATA	THE UMA GROUP
110	19	BMINES-1	2D/3D FINITE ELEMENT	AGDABIAN ASSOCIATES
111	20	MINECAN	MINERAL FEASIBILITY STUDIES/ECONOMICS	CONTROL DATA CORPORATION

RUNNING COUNT	ACTIVITY NO	MODULE NAME	ABSTRACT	COMPANY NAME
112	20	MINTEC5	MINE PLANNING & DESIGN	COMPUTER SCIENCE CORP.
113	20	EVA	FINANCIAL MODEL	SMC.INC-MININGSMETALLURGY DIV.
114	20	EVAL 5	MINERAL PROPERTY FINANCIAL EVALUATION	CONTROL DATA CORPORATION
115	20	FIPAC 5	FINANCIAL PLANNING LANGUAGE	CONTROL DATA CORPORATION
116	20	IFPS	FINANCIAL PLANNING SYSTEM	CONTROL DATA CORPORATION
117	20	MINECOST	MINE COST AND BUDGET ESTIMATION	MINCOM PTY LTD
118	21	MINTEC6	MINE PLANNING & DESIGN	COMPUTER SCIENCE CORP.
119	21	CPS-1	GEOMODELNG TOOL,3D CONSTRCTN-GEOSTRUCTRS BUILDSREVISE ACCUR	MARSTONMARSTON,INC
120	21	POS	MATHMTCLLY OPTMZD DESIGN OF ANY SET ENGRNGCOST CONTRAINS	INTERNATIONAL GEOSYSTEM CORPORATION
121	21	FCONE	ULTIMATE PIT ANALYSIS	CONTROL DATA CORPORATION
122	21	MULTIPIT	ULTIMATE PIT CALCLTN-W-PARAMETRZTN ON RESEVS TECHNQUE	GEOMATH INC.
123	22	ISMAPS	COMPLETE UNDERGROUND SURVEY SYSTEM	CENTRE DE RECHERCHE NORANDA
124	22	PREMINI	USER FRIENDLY CPM BASED PROJECT MANAGEMENT TOOL	CONTROL DATA CORPORATION
125	22	LAB EQP AU	CONTROL OF MECH. TEST EQUIP	MTS SYSTEMS CORP
126	22	MATHPROTRN	PROBLEM SOLVING SYSTEM FOR MATHEMATICS	IMSL,SALES DIV.
127	23	MINETICS		REL-TEK/MINRTICS CORP.
128	24	EVENT-CONV	EVENT-BASED MODEL OF CONVEYOR OPERATIONS IN OIL SANDS	NATIONAL RESEARCH COUNCIL,DIV.MECHANICAL ENG.SYSTEMS LABORATORY
129	24	CONVEYOR-M	MATHTCAL MODEL POWER REQRMNT FOR DIFFERENT CONVEYOR DESIGNS	NATIONAL RESEARCH COUNCIL,DIV.MECHANICAL ENG.SYSTEMS LABORATORY
130	24	MSS	INCORPORTS-TARGET-PRELIMNRY&DETAILD SCHEDULING OF TOTAL MINN	EXPLORATION COMPUTER SERVICES INC.
131	24	X2		REL-TEK/MINRTICS CORP.
132	24	TALPAC	ASSESSES TRUCK&LOADER PRODUCTVTY,CYCLE TIME CALCLTNS	CONTROL DATA CORPORATION
133	25	T/SEVNTBSD	EVENTBASED MODEL OF TRUCK/SHOVEL/LOADER OPERATIONS	NATIONAL RESEARCH COUNCIL,DIV.MECHANICAL ENG.SYSTEMS LABORATORY
134	25	T/S-MATH/M	MATHCAL MODEL CALCULATE CYCLETIME OF TRUCK/SHOVEL/LOADER	NATIONAL RESEARCH COUNCIL,DIV.MECHANICAL ENG.SYSTEMS LABORATORY
135	25	MSS-TRUCK	CALCULATES TRUCKS CYCLE T.& # OF UNITS/RIMPULL,SPEEDLIMITS,R	EXPLORATION COMPUTER SERVICES INC.
136	25	X3		REL-TEK/MINRTICS CORP.
137	25	TALPAC	ASSESSES TRUCK AND LOADER PRODUCTIVITY	MINING SOFTWARE ASSOCIATES
138	25	SIMP	SIMULATES CONVEYOR,STORAGE,HOISTING AND SURFACE STORAGE	THE CAMBRIAN ENGINEERING GROUP LTD.
139	25	TAS-II	TRUCK AND SHOVEL SPOILS GRADING	INSTITUTE OF NATURAL RESOURCES,MONTANA STATE UNIVERSITY
140	26	X4		REL-TEK/MINRTICS CORP.
141	27	BIN/HOPPER	EVENT-BASED MODEL OF BIN/HOPPER OPERATIONS IN OIL SANDS	NATIONAL RESEARCH COUNCIL,DIV.MECHANICAL ENG.SYSTEMS LABORATORY
142	27	D/L-MATH/M	MATHNCAL/GEOMETRICAL DRAGLINE OPERTN MODELLING OIL SANDS	NATIONAL RESEARCH COUNCIL,DIV.MECHANICAL ENG.SYSTEMS LABORATORY
143	27	MSS-D/L	SIMULATES D/L,EXTEDD BENCH,CHOP,PULL BACK/SHOVEL,DOZER SIMLT	EXPLORATION COMPUTER SERVICES INC.

APPENDIX 3D
SOFTWARE MODULES WITH MARKETING OPTIONS
QUESTIONNAIRE RESULTS
LEGEND : Activity 1 to 44 ,see Questionnaire form, Appendix 1A

RUNNING COUNT	ACTIVITY NO	MODULE NAME	ABSTRACT	COMPANY NAME
144	27	GEOMIN-12	DRAGLINE OP-SIMULATION&SCHEDLING OF STRIP MINING	GEOMIN COMPUTER SERVICES CORP
145	27	DETSIM	DETERMINATION DES TEMPS DE CYCLES DE CAMIONS ET DE TRAINS	UNIVERSITE LAVAL,DEPT.MINES ET METALLURGIE
146	27	PITSIM	OPTIMISATION D,UNE FLOTTE DE PELLE ET DE CAMION	UNIVERSITE LAVAL,DEPT.MINES ET METALLURGIE
147	27	SIMSOUT	DU SOUTIRAGE DU MINERAI DANS UN CHANTIER SOUTERRAIN	UNIVERSITE LAVAL,DEPT.MINES ET METALLURGIE
148	27	X5		REL-TEK/MINRTICS CORP.
149	27	PITSIM-II	OPTIMIZTN O.PIT LOADING&HAULING SYST,LP DISPATCHGN ALGO,MIN.H	QUEENS-U.
150	27	DRGSIM	MULTISEAM DRAGLN SIMULATN-DETAILD-ANALYS/OPTMZTN 3D	MINING SOFTWARE ASSOCIATES
151	27	D/LEVNTBSD	EVENTBASED MODEL DRAGLINE OPERTN'BUILDING OILSAND WINDROW	NATIONAL RESEARCH COUNCIL,DIV.MECHANICAL ENG.SYSTEMS LABORATORY
152	27	B/W-MODEL	EVENTBASED MODEL BUCKETWHEEL OPERTN IN OIL-SANDS	NATIONAL RESEARCH COUNCIL,DIV.MECHANICAL ENG.SYSTEMS LABORATORY
153	27	SIMP-2	SIMULATION OF CONTINUOUS MINER OPERATION	THE CAMBRIAN ENGINEERING GROUP LTD.
154	27	'DRAG'	DRAGLINE SPOILS GRADING	INSTITUTE OF NATURAL RESOURCES,MONTANA STATE UNIVERSITY
155	27	MATHMINE2	SEE PAMPHLET	MARTIN MARIETTA DATA SYSTEMS
156	28	GEOMIN-13	SCHEDULLING AND REPORTING UNDERGROUND MINING OPRTN	GEOMIN COMPUTER SERVICES CORP
157	28	MATHMINE3	SEE PAMPHLET	MARTIN MARIETTA DATA SYSTEMS
158	29	GEOPRD	SURFACEMINE PROD&EQIP-PERFORMANCE ANALYSIS&REPORTNG	GEOMIN COMPUTER SERVICES CORP
159	29	X6		REL-TEK/MINRTICS CORP.
160	30	X7		REL-TEK/MINRTICS CORP.
161	31	BLASTHOLE	GRAPHICLY REPRESENTS OPEN STOPE BLASTS FOR BURDEN SPACINGS	CENTRE DE RECHERCHE NORANDA
162	31	BLENDING	OPTIMIZED BLENDING PROGRAM	CONTROL DATA CORPORATION
163	31	CLAIMIIGRD	CLAIM II SPOILS GRADING PROGRAM	INSTITUTE OF NATURAL RESOURCES,MONTANA STATE UNIVERSITY
164	31	GROMOD	GROUNDWATER MODELLING	CONTROL DATA CORPORATION
165	32	ROCMEC	STABILITY ANAL/RCK SLOPES,WEDGE FAILURE,GEOLOG STRUCT ANALYS	CONTROL DATA CORPORATION
166	32	SLOPE II	SLOPE STABILITY	CONTROL DATA CORPORATION
167	32	X8		REL-TEK/MINRTICS CORP.
168	32	BMINES-2	2D/3D FINITE ELEMENT	AGBABIAN ASSOCIATES
169	33	BMINES-3	2D/3D FINITE ELEMENT	AGBABIAN ASSOCIATES
170	34	MIVENDES	MINE VENTILATION SYSTEM	CONTROL DATA CORPORATION
171	34	PSUMVS	SIMULATION D,UN RESEAU D,AERAGE	UNIVERSITE LAVAL,DEPT.MINES ET METALLURGIE
172	34	GEOVNT	UNDERGROUND MINE VENTILATION ANALYSIS&DESIGN	GEOMIN COMPUTER SERVICES CORP
173	34	X9		REL-TEK/MINRTICS CORP.
174	34	M.M.V.S.	MDLS M.VENT-SYST/HARDY-CROSS ALGO-KIRCHHOFF ON NETWORK/FANS	QUEENS-U.
175	35	GRNDWATER	HYDROLOGIC MODELLING/DISPLAY&ANALISYS	GEOMIN COMPUTER SERVICES CORP
176	35	X10		REL-TEK/MINRTICS CORP.
177	35	OCC-EXPSR	LIFETIME CONTMNTS RECORDS:RADON,THARON,GAMMA,DUST,SIO2,NOISE	RIO ALGOM LIMITED-ELLIOT LAKE
178	35	WIND SYS	TX WEATHER DATA TO HR/DAILY/MONTH WIND ROSES	AFTON OPERATING CORPORATION
179	35	WQ SYS	WQ,FLOW & PREGOMETER LEVEL GEN STAT REPORT/GRAPH	AFTON OPERATING CORPORATION
180	35	CLAIMIIFEA	CLAIM II ENVIRONMENTAL FEASIBILITY MODULE	INSTITUTE OF NATURAL RESOURCES,MONTANA STATE

RUNNING COUNT	ACTIVITY NO	MODULE NAME	ABSTRACT	COMPANY NAME
181	35	AQ SYS	COLL AND.A Q DATA/GEN STAT REP & GRAPHS	AFTON OPERATING CORPORATION
182	37	M-MGNER/30	MINE OP DBM/ACC,WAREHOUSE,PAYROLL,PO,MAIN	MANAX DATA SYSTEMS
183	37	MATHMINE4	SEE PAMPHLET	MARTIN MARIETTA DATA SYSTEMS
184	37	X1	CONTROL OF MECH. TEST EQUIP	MTS SYSTEMS CORP
185	38	X11		REL-TEK/MINRTICS CORP.
186	38	COOL	MODELS POND EVPORATIVE COOLING FOR USE IN POTASH MINES	THE CAMBRIAN ENGINEERING GROUP LTD.
187	38	ASPENPLUS1	SIMULATE P&C OF PETRO-CHEM PLANT	ASPEN TECHNOLOGY,INC.
188	38	MATHMINE5	SEE PAMPHLET	MARTIN MARIETTA DATA SYSTEMS
189	38	DIGIT/AREA	DIGITIZING&AREA CALCULATION UTILITY,LISTS DATA IN M.&FT.	CONTROL DATA CORPORATION
190	38	EXTRACTIVE	MASS AND ENERGY BALANCE FOR EXTRACTIVE MINERAL PROCESSING	CONTROL DATA CORPORATION
191	38	X2	CONTROL OF MECH. TEST EQUIP	MTS SYSTEMS CORP
192	39	MINCOST	PROJECT COST ACCOUNTING SYSTEM	CONTROL DATA CORPORATION
193	39	GEOFIN	MIN-DEPOSITS&MINING-OP-FINANCIAL EVALUATION	GEOMIN COMPUTER SERVICES CORP
194	39	OPCOST	MINE COST BUDGETING PROGRAM	PINCOCK,ALLEN & HOLT,INC.
195	39	FISCAL	4TH GENERTN LANGAUGE FOR FINANCL APPLCTN	MINCOM PTY LTD
196	39	MATHMINE6	SEE PAMPHLET	MARTIN MARIETTA DATA SYSTEMS
197	39	CLAIMIITCN	CLAIM II/TECON	INSTITUTE OF NATURAL RESOURCES,MONTANA STATE UNIVERSITY
198	39	ASPENPLUS2	SIMULATE P&C OF PETRO-CHEM PLANT	ASPEN TECHNOLOGY,INC.
199	40	GEOMEC	GEOTECHNICAL DATA MANAGEMENT AND DISPLAYS	MINCOM PTY LTD
200	40	GEOTCHNICS	GEOL/STRUCTURAL-INFO&STABILITY ANALYSIS/DISPLAY	GEOMIN COMPUTER SERVICES CORP
201	40	BOUDEM_DIS	CALCUL DE CONTRAINTES	UNIVERSITE LAVAL,DEPT.MINES ET METALLURGIE
202	40	ROCKMECHCS	SURF&UNDERGRND STRESS&DEFORMATION MODELLING&ANALYSIS	GEOMIN COMPUTER SERVICES CORP
203	40	SAP2D77	GENERALIZED FINITE ELEMENT ANALYSIS FOR U/G EXCAVATIONS	CENTRE DE RECHERCHE NORANDA
204	40	MINTAB	CALCUL DE CONTRAINTE ENGISEMENT TABULAIRE	UNIVERSITE LAVAL,DEPT.MINES ET METALLURGIE
205	40	GEOTEC/LOG	ANLSIS&GRAPCAL-DSPLY GTECDATA-STERFONTS,LO EDGE,PROJTN	INTERNATIONAL GEOSYSTEM CORPORATION
206	40	X3	CONTROL OF MECH. TEST EQUIP	MTS SYSTEMS CORP
207	41	X12		REL-TEK/MINRTICS CORP.
208	42	X13		REL-TEK/MINRTICS CORP.
209	42	PERSONNEL	INFORMATION SUR LE PERSONNEL	NOTHGATE PATINO MINES INC.
210	42	ANADAP-PER	SEE PAMPHLET	ANALYTICAL DATA PROCESSING
211	42	SIR/DBMS4	SEE PAMPHLET	S.I.R. INC.
212	43	GEOMNT	SURFACE&UNDRGRND MINE EQUIP-MAINTNCEMANGMNT&CONTROL	GEOMIN COMPUTER SERVICES CORP
213	43	MITIS	TIRE INFORMATION SYSTEM	CONTROL DATA CORPORATION
214	43	GEOTRK	MINE EQUIP/TIRE INFO-CONTROL-REPORTING	GEOMIN COMPUTER SERVICES CORP
215	43	MPSS	EQUIPMNT MAINTNC PLNNG&SCHDLNG-MENUDRIVEN-10/18ITEMS@	RIO ALGOM LIMITED-ELLIOT LAKE
216	43	X14		REL-TEK/MINRTICS CORP.
217	43	MAINTENANCE	MAINTENANCE SCHEDULING MODULE-MINMS SYSTEM	MINCOM PTY LTD
218	43	CYBERGEM	ASSISTS IN ALL AREAS OF MAINTENANCE	CONTROL DATA CORPORATION
219	44	MCBUD	BUDGETING	CONTROL DATA CORPORATION
220	44	MINPAY	PAYROL SYSTEME HANDLING MININGSITUATIONS COMPLEXITIES	MINCOM PTY LTD
221	44	MINMS	INTEGRATED MINE MANAGEMENT SYSTEMS	MINCOM PTY LTD
222	44	MICA/ABECA	INTEGRATED COST ACCOUNTING	ARGOS SOFTWARE
223	44	SUPPLY	SUPPLY-INVENTORYCONTROL,PURCHASING AND ACCOUNTS PAYABLE SYST	MINCOM PTY LTD

LEGEND:

XXX / YYY = NAME / VENDOR
BLANK = NOT SPECIFIED
Y = YES BUT NOT SPECIFIED

STATISTICS LIBRARIES	MATHEMATICAL LIBRARIES	DEVICE INDEPENDENT GRAPHICS LIBRARIES	DEVICE DEPENDENT GRAPHICS LIBRARIES
			CALCOMP
			CALCOMP
			HP
			CALCOMP
			CALCOMP
			CALCOMP
		TRANSLATE/NRC	
			HP
			HP
			0
			HP
		HP-AGP	HP-CALCOMP
		CUSTOM/INHOUSE	PLOT10/TEXTRONIX
		SHL	SHL
	IN-HOUSE	IN-HOUSE	
	IN-HOUSE	IN-HOUSE	
			IGDS/INTERGRAPH
			CEADS
			CEADS
			HP
	ALLAN BRADLY		
			CALCOMP
			CALCOMP
	Y_NONE/DEC	D13000/IGL/TEKT	ZETAL IB/ZETA
	Y_NONE/DEC	D13000/IGL/TEKT	ZETAL IB/ZETA
	Y_NONE/DEC	D13000/IGL/TEKT	ZETAL IB/ZETA
	Y_NONE/DEC	D13000/IGL/TEKT	ZETAL IB/ZETA
	Y_NONE/DEC	D13000/IGL/TEKT	ZETAL IB/ZETA
			EVANS&SUTHRNLND
			HP
			HP
			0
			0
			HP
		PLOT10	
			CEADS
			CEADS
			CEADS
			CEADS
			CEADS
	Y_NONE/DEC	D13000/IGL/TEKT	ZETAL IB/ZETA
	Y_NONE/DEC	D13000/IGL/TEKT	ZETAL IB/ZETA
			DGL-AGP
			MTS

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Y = YES BUT NOT SPECIFIED

STATISTICS LIBRARIES	MATHEMATICAL LIBRARIES	DEVICE INDEPENDENT GRAPHICS LIBRARIES	DEVICE DEPENDENT GRAPHICS LIBRARIES
			MTS
			MTS
			MTS
		Y	
		Y	
		Y	
		Y	
		Y	
			CALCOMP
			CALCOMP
		Y	
			CALCOMP
			APPLICON
Y			E&S MPPS
Y			E&S MPPS
ALADIN	1-2-3		
ANADAP-STAT	ANADAP		
ANADAP-STAT	ANADAP		
B-GRAPH		B-GRAPH	
B-GRAPH		B-GRAPH	
B-GRAPH		B-GRAPH	
B-GRAPH		B-GRAPH	
B-GRAPH		B-GRAPH	
B-GRAPH		B-GRAPH	
B-GRAPH		B-GRAPH	
B-GRAPH		B-GRAPH	
BMDP	IMSL	DI-3000	CALCOMP
BMDP/SPSS/SAS		SIR/GRAPH	
BMDP/SPSS/SAS		SIR/GRAPH	
BMDP/SPSS/SAS		SIR/GRAPH	
BMDP/SPSS/SAS		SIR/GRAPH	
BMDP/U OF CALG	GEE/RND		
BMDP/U OF CALG	GEE/RND	DI-3000	CALCOMP
BMDP/U OF CALG	GEE/RND		
BMDP/U OF CALG	GEE/RND		
COSAP			
COSAP			
COSAP			
DEC/IBM	DEC/IBM	IN HOUSE	IN HOUSE
DEC/IBM	DEC/IBM	IN HOUSE	IN HOUSE
DEC/IBM	DEC/IBM	IN HOUSE	IN HOUSE
DEC/IBM	DEC/IBM	IN HOUSE	IN HOUSE
DEC/IBM	DEC/IBM	IN HOUSE	IN HOUSE
DEC/IBM	DEC/IBM	IN HOUSE	IN HOUSE
DEC/IBM	DEC/IBM	IN HOUSE	IN HOUSE
DEC/IBM	DEC/IBM	IN HOUSE	IN HOUSE

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Y = YES BUT NOT SPECIFIED

STATISTICS LIBRARIES	MATHEMATICAL LIBRARIES	DEVICE INDEPENDENT GRAPHICS LIBRARIES	DEVICE DEPENDENT GRAPHICS LIBRARIES
HP		HP	HP
HP		HP	HP
HP		HP	HP
HP		HP	HP
HP		HP	HP
HP		HP	HP
HP		HP	HP
HP		HP	HP
HP	HP		HP
HP			
HP			
HP	HP	HP	LOG/MATE
HP	HP		HP
HP	HP		HP
HP	HP		HP
HP	HP		HP
HP	HP		HP
HP	HP		HP
HP STAT PACKG	HP STAT PACKG		
HP STAT PACKG	HP STAT PACKG		
HP STAT PACKG	HP STAT PACKG		
IBM	IBM	IBM	IBM
IBM	IBM	IBM	IBM
IBM	IBM	IBM	IBM
IBM	IBM	IBM	IBM
IBM	IBM	IBM	IBM
IBM/IN HOUSE	IBM/PRIME	IN HOUSE/GDS	CALCOMP/HOLLOSO
IBM/IN HOUSE	IBM/PRIME	IN HOUSE/GDS	CALCOMP/HOLLOSO
IBM/IN HOUSE	IBM/PRIME	IN HOUSE/GDS	CALCOMP/HOLLOSO
IBM/IN HOUSE	IBM/PRIME	IN HOUSE/GDS	CALCOMP/HOLLOSO
IBM/IN HOUSE	IBM/PRIME	IN HOUSE/GDS	CALCOMP/HOLLOSO
IBM/INHOUSE	IBM/PRIME	INHOUSE/GDS	CALCOMP/HALLSNC
IGC	IGC	IGC	IGC
IGC	IGC	IGC	IGC
IGC	IGC	IGC	IGC
IMSL	IMSL		G1000/HP,P10/TEX
MANY	MANY	HOUSTON INST	
MINITAB			
MINITAB			CALCOMP
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM

SYSTEMS SOFTWARE: APPLICATION SUPPORT LIBRARIES

LEGEND:

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BLANK = NOT SPECIFIED
Y = YES BUT NOT SPECIFIED

STATISTICS LIBRARIES	MATHEMATICAL LIBRARIES	DEVICE INDEPENDENT GRAPHICS LIBRARIES	DEVICE DEPENDENT GRAPHICS LIBRARIES
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
QSTAT/HP	QSTAT/HP	LAMBDA	
QSTAT/HP	QSTAT/HP	LAMBDA	
QSTAT/HP	QSTAT/HP	LAMBDA	
QSTAT/HP	QSTAT/HP	LAMBDA	
QSTAT/HP	QSTAT/HP	LAMBDA	
QSTAT/HP	QSTAT/HP	LAMBDA	
SAS-BIO/MED		SAS/GRAPH	VARIAN

SYSTEMS SOFTWARE: APPLICATION SUPPORT LIBRARIES

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STATISTICS LIBRARIES	MATHEMATICAL LIBRARIES	DEVICE INDEPENDENT GRAPHICS LIBRARIES	DEVICE DEPENDENT GRAPHICS LIBRARIES
SASS/SPSS		SASS	
SASS/SPSS		SASS	
SASS/SPSS		SASS	
SASS/SPSS		SASS	
SASS/SPSS		SASS	
SASS/SPSS		SASS	
SPERRY	SPERRY	IN-HOUSE DEV.	
SPERRY/OWN	SPERRY		
SPERRY/OWN	SPERRY		
SPERRY/OWN	SPERRY		
SPERRY/OWN	SPERRY		
SPERRY/OWN	SPERRY		
SPERRY/OWN	SPERRY		
SPERRY/OWN	SPERRY		
SPERRY/OWN	SPERRY		
SPERRY/OWN	SPERRY		
SPERRY/OWN	SPERRY		
SPERRY/OWN	SPERRY		
SPSS	BMDP	SKETCH(INTERNAL	
SPSS	BMDP	SKETCH(INTERNAL	
SPSS	BMDP	SKETCH(INTERNAL	
SPSS	BMDP	SKETCH(INTERNAL	
SPSS	BMDP	SKETCH(INTERNAL	
SPSS		FORTRAN	REGIS,PLOT 10
SPSS		FORTRAN	REGIS,PLOT 10
SPSS		FORTRAN	REGIS,PLOT 10
SPSS		FORTRAN	REGIS,PLOT 10
SPSS		FORTRAN	REGIS,PLOT 10
SPSS	BMDP	SKETCH(INTERNAL	
SPSS		FORTRAN	REGIS,PLOT 10
SPSS		FORTRAN	REGIS,PLOT 10
SPSS		FORTRAN	REGIS,PLOT 10
SPSS		FORTRAN	REGIS,PLOT 10
SPSS		FORTRAN	REGIS,PLOT 10
SPSS		FORTRAN	REGIS,PLOT 10
SPSS		FORTRAN	REGIS,PLOT 10
SPSS		FORTRAN	REGIS,PLOT 10
SYSLIB/HP	SYSLIB/HP	DGL/HP	DGL/HP
SYSLIB/HP	SYSLIB/HP	DGL/HP	DGL/HP
SYSLIB/HP	SYSLIB/HP	DGL/HP	DGL/HP
SYSLIB/HP	SYSLIB/HP	DGL/HP	DGL/HP
SYSLIB/HP	SYSLIB/HP	DGL/HP	DGL/HP

LEGEND:

XXX / YYY = NAME / VENDOR
BLANK = NOT SPECIFIED
Y = YES BUT NOT SPECIFIED

STATISTICS LIBRARIES	MATHEMATICAL LIBRARIES	DEVICE INDEPENDENT GRAPHICS LIBRARIES	DEVICE DEPENDENT GRAPHICS LIBRARIES
T-EDC	WANG		
T-EDC	WANG		
T-EDC	WANG		
T-EDC	WANG		
T-EDC	WANG		
T-EDC	WANG		
T-EDC	WANG		
T-EDC	WANG		
T-EDC	WANG		
T-EDC	WANG		
T-EDC	WANG		
T-EDC	WANG		
T-EDC	WANG		
VARIOUS	VARIOUS		DEC&HONEYWELL
VARIOUS	VARIOUS		DEC&HONEYWELL
VARIOUS	VARIOUS		DEC&HONEYWELL
VARIOUS	VARIOUS		DEC&HONEYWELL
VARIOUS	VARIOUS		DEC&HONEYWELL
VARIOUS	VARIOUS		DEC&HONEYWELL
VARIOUS	VARIOUS		DEC&HONEYWELL
VARIOUS	VARIOUS		DEC&HONEYWELL
VARIOUS	VARIOUS		DEC&HONEYWELL
VARIOUS	VARIOUS		DEC&HONEYWELL
VARIOUS	VARIOUS		DEC&HONEYWELL
Y			
Y			
BMDP	IMSL	DI-3000	CALCOMP
BMDP	IMSL	DI-3000	CALCOMP
BMDP	IMSL	DI-3000	CALCOMP
BMDP	IMSL	DI-3000	CALCOMP
BMDP	IMSL	DI-3000	CALCOMP
HP	HP		
HP	HP		
HP USERSGROUP			
IGC	IGC	IGC	IGC
IMS LIBRY/IBM			
MEDSYSTEM/MIN			
MEDYSYSTEM/MI		HCGS/TEXPRINT	CALCOMP BASIC
MICROSOFT	MULTIPLAN		
PROTRAN			
SAS			
SPSS			
SPSS/SPSS	IMSL/IMSL	TEL-A-GRAPH/I	PLOT-10/TEKTR
SPSS/SPSS	IMSL/IMSL	TEL-A-GRAPH/I	PLOT-10/TEKTR
SPSS/SPSS	IMSL/IMSL	TEL-A-GRAPH/I	PLOT-10/TEKTR

APPENDIX 4B

SYSTEMS SOFTWARE: DEVICE SUPPORT SOFTWARE
RESPONSES TO QUESTIONNAIRE

LEGEND:

XXX / YYY = NAME / VENDOR
BLANK = NOT SPECIFIED
Y = YES BUT NOT SPECIFIED

GRAPHICS DEVICE DRIVER	COMMUNICATIONS/ NETWORK	TERMINAL CONTROLLER	QUEUE SUPPORT
	YVMS/DEC		
	PRIMENET/PRIME		
	PRIMENET/PRIME		
	PRIMENET/PRIME		
		3-SSP/IBM	4-SSP/IBM
		3-SSP/IBM	4-SSP/IBM
	SPERRY	SPERRY	
	DECNET/DEC		
	DECNET/DEC		
	DECNET/DEC		
	BI-SYNC-IBM		
	IN-TOUCH		
	NCR (UNIX)	Y	Y
		IBM	IBM
		ALLAN BRADLY	
		IBM	IBM
	Y	Y	Y
	Y	Y	Y
	Y	Y	Y
	3270/IBM	3274/ITT COURIER	
		3-SSP/IBM	4-SSP/IBM
		3-SSP/IBM	4-SSP/IBM
		3-SSP/IBM	4-SSP/IBM
		IBM	IBM
		TDM/DIGITAL	
		TDM/DIGITAL	
	PRIMENET/PRIME		
	PRIMENET/PRIME		
	PRIMENET/PRIME		
	PRIMENET/PRIME		
	PRIMENET/PRIME		
	PRIMENET/PRIME		
	TELENET	IBM3705	
		IBM	IBM
		IBM	IBM
		IBM	IBM
	Y	Y	Y
	Y	Y	Y
	Y	Y	Y
	PRIMENET/PRIME		
	PRIMENET/PRIME		
	PRIMENET/PRIME		

SYSTEMS SOFTWARE: DEVICE SUPPORT SOFTWARE
RESPONSES TO QUESTIONNAIRE

LEGEND:

XXX / YYY = NAME / VENDOR
BLANK = NOT SPECIFIED
Y = YES BUT NOT SPECIFIED

GRAPHICS DEVICE DRIVER	COMMUNICATIONS/ NETWORK	TERMINAL CONTROLLER	QUEUE SUPPORT
Y	IBM-RYDEX	Y	IBM
Y	IBM,RYDEX	Y	IBM
Y		Y	
Y	IBM,RYDEX	Y	IBM
Y	IBM,RYDEX	Y	IBM
Y	Y		
CALCOMP			
CALCOMP			
CALCOMP			
CALCOMP,TEKTRNX	PRIMENET/PRIME	AMLG,MDLC/PRIME	BATCH,SPOOLR/PR
CALCOMP,TEKTRNX	PRIMENET/PRIME	AMLG,MDLC/PRIME	BATCH,SPOOLR/PR
CALCOMP,TEKTRNX	PRIMENET/PRIME	AMLG,MDLC/PRIME	BATCH,SPOOLR/PR
CALCOMP,TEKTRNX	PRIMENET/PRIME	AMLG,MDLC/PRIME	BATCH,SPOOLR/PR
CALCOMP,TEKTRNX	PRIMENET/PRIME	AMLG,MDLC/PRIME	BATCH,SPOOLR/PR
CALCOMP/CALCOMP	IBM/BTAM	TDM/DIGITAL EQU	
CALCOMP/CALCOMP	IBM/BTAM		
CALCOMP/CALCOMP	IBM/BTAM		
CALCOMP/CALCOMP	IBM/BTAM		
CALCOMP/TEKTRNX			
CALCOMP/TEKTRNX			
CALCOMP/TEKTRNX			
CALCOMP/TEKTRNX			
CALCOMP/TEKTRNX			
CALCOMP/TEKTRNX	PRIMENET/PRIME	AMLG,MDLC/PRIME	BTCH,SPOOLR/PRM
CALCOMP/TEKTRNX			
CALCOMP/TEKTRNX			
CALCOMP/TEKTRNX			
DEC/HP		DEC/HP	DEC
DEC/HP		DEC/HP	DEC
DEC/HP		DEC/HP	DEC
DGL/HP	IDM00/HP	DD.00/HP	SPOOL/HP
DGL/HP	IDM00/HP	DD.00/HP	SPOOL/HP
DGL/HP	IDM00/HP	DD.00/HP	SPOOL/HP
DGL/HP	IDM00/HP	DD.00/HP	SPOOL/HP
DGL/HP	IDM00/HP	DD.00/HP	SPOOL/HP
DIGITAL			
DIGITAL			
DIGITAL			
DIGITAL			
DIGITAL			
DIGITAL			
DIGITAL			

SYSTEMS SOFTWARE: DEVICE SUPPORT SOFTWARE
RESPONSES TO QUESTIONNAIRE

LEGEND:

XXX / YYY = NAME / VENDOR
BLANK = NOT SPECIFIED
Y = YES BUT NOT SPECIFIED

GRAPHICS DEVICE DRIVER	COMMUNICATIONS/ NETWORK	TERMINAL CONTROLLER	QUEUE SUPPORT
DIGITAL			
DIGITAL			
DIGITAL			
DIGITAL			
DIGITAL			
DIGITAL			
DIGITAL			
DIGITAL			
DIGITAL			
DIGITAL			
DIGITAL			
DIGITAL			
DIGITAL			
DIGITAL			
DIGITAL			
DIGITAL			
G1000II/HP,P10	CYBERNET		
HP	HP	HP	HP
HP	HP		
HP	HP	HP	
HP	HP		
HP	HP		
HP	HP		
HP 150	DS3000/HP		
HP 150/HP	DS3000/HP		
IGDS/INTERGRAPH			
IN-HOUSE	PACX	IN-HOUSE	
IN-HOUSE	PACX	IN-HOUSE	
KMW	SPERRY	SPERRY	
KMW	SPERRY	SPERRY	
KMW	SPERRY	SPERRY	
KMW	SPERRY	SPERRY	
KMW	SPERRY	SPERRY	
KMW	SPERRY	SPERRY	
KMW	SPERRY	SPERRY	
KMW	SPERRY	SPERRY	
KMW	SPERRY	SPERRY	
KMW	SPERRY	SPERRY	
KMW	SPERRY	SPERRY	
KMW	SPERRY	SPERRY	
MTS	MTS	MTS	
MTS	MTS	MTS	

SYSTEMS SOFTWARE: DEVICE SUPPORT SOFTWARE
RESPONSES TO QUESTIONNAIRE

LEGEND:

XXX / YYY = NAME / VENDOR
BLANK = NOT SPECIFIED
Y = YES BUT NOT SPECIFIED

GRAPHICS DEVICE DRIVER	COMMUNICATIONS/ NETWORK	TERMINAL CONTROLLER	QUEUE SUPPORT
MTS	MTS	MTS	
MTS	MTS	MTS	
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM
PC-PLOT/GOLDEN			
PC-PLOT/GOLDEN			
PC-PLOT/GOLDEN			
PC-PLOT/GOLDEN			
PC-PLOT/GOLDEN			
PENDING	HONEYWELL	HONEYWELL	HONEYWELL
PENDING	HONEYWELL	HONEYWELL	HONEYWELL
PENDING	HONEYWELL	HONEYWELL	HONEYWELL
PENDING	HONEYWELL	HONEYWELL	HONEYWELL
PENDING	HONEYWELL	HONEYWELL	HONEYWELL
PENDING	HONEYWELL	HONEYWELL	HONEYWELL
PENDING	HONEYWELL	HONEYWELL	HONEYWELL
PENDING	HONEYWELL	HONEYWELL	HONEYWELL
PENDING	HONEYWELL	HONEYWELL	HONEYWELL
PENDING	HONEYWELL	HONEYWELL	HONEYWELL
PENDING	HONEYWELL	HONEYWELL	HONEYWELL
REGIS,PLOT 10	VAX/VMS	DATASWITCH/DEVE	VAX/VMS
REGIS,PLOT 10	VAX/VMS	DATASWITCH/DEVE	VAX/VMS
REGIS,PLOT 10	VAX/VMS	DATASWITCH/DEVE	VAX/VMS
REGIS,PLOT 10	VAX/VMS	DATASWITCH/DEVE	VAX/VMS
REGIS,PLOT 10	VAX/VMS	DATASWITCH/DEVE	VAX/VMS
REGIS,PLOT 10	VAX/VMS	DATASWITCH/DEVE	VAX/VMS
REGIS,PLOT 10	VAX/VMS	DATASWITCH/DEVE	VAX/VMS
REGIS,PLOT 10	VAX/VMS	DATASWITCH/DEVE	VAX/VMS
REGIS,PLOT 10	VAX/VMS	DATASWITCH/DEVE	VAX/VMS

SYSTEMS SOFTWARE: DEVICE SUPPORT SOFTWARE
RESPONSES TO QUESTIONNAIRE

LEGEND:

XXX / YYY = NAME / VENDOR
BLANK = NOT SPECIFIED
Y = YES BUT NOT SPECIFIED

GRAPHICS DEVICE DRIVER	COMMUNICATIONS/ NETWORK	TERMINAL CONTROLLER	QUEUE SUPPORT
REGIS,PLOT 10	VAX/VMS	DATASWITCH/DEVE	VAX/VMS
REGIS,PLOT 10	VAX/VMS	DATASWITCH/DEVE	VAX/VMS
REGIS,PLOT 10	VAX/VMS	DATASWITCH/DEVE	VAX/VMS
SAS	ACF-TCAM/IBM	EP/IBM	JES2/IBM

SYSTEMS SOFTWARE: DEVICE SUPPORT SOFTWARE
RESPONSES TO QUESTIONNAIRE

LEGEND:

XXX / YYY = NAME / VENDOR
BLANK = NOT SPECIFIED
Y = YES BUT NOT SPECIFIED

GRAPHICS DEVICE DRIVER	COMMUNICATIONS/ NETWORK	TERMINAL CONTROLLER	QUEUE SUPPORT
CALCOMP			
CALCOMP			
CALCOMP			
CALCOMP			
DI-3000			
DI-3000			
DI-3000			
DI-3000			
DI-3000			
HCGS/TEXPRINT	VMS/DEC	SAME	SAME
HP		HP	
HP		HP	
HP		HP	
HP		HP	
HP		HP	
HP		HP	
HP		HP	
HP150/HP	DS3000/HP		
IGC			
IN HOUSE		IN HOUSE	
IN HOUSE		Y	
SHL			
VS11/DEC	DECNET/DEC	VMS/DEC	VMS/DEC
ZETA			
ZETA			
ZETA			
ZETA			
ZETA			
ZETA			
ZETA			
ZETA			

APPENDIX 4C

SYSTEMS SOFTWARE: DATA MANAGEMENT SOFTWARE

LEGEND:

XXX / YYY = NAME / VENDOR
BLANK = NOT SPECIFIED
Y = YES BUT NOT SPECIFIED

DATABASE MANAGEMENT	DATA DICTIONARY	QUERY LANGUAGE	ARCHIVE	BACK-UP AND RESTORE
				VMS/DEC
				HP
			MAGSAV/LST/LOAD	LOAD/DUMP/LST
			MAGSAV/LST/LOAD	LOAD/DUMP/LST
			MAGSAV/LST/LOAD	LOAD/DUMP/LST
				HP
				HP
		IBM		IBM
				HP
				Y
	SHL	SHL	SHL	SHL
		IBM		IBM
	DTR/DEC	DTR&FORTRAN	BACKUP COOBOL/D	BACKUP/DEC
	DTR/DEC	DTR&FORTRAN	BACKUP COOBOL/D	BACKUP/DEC
	DTR/DEC	DTR&FORTRAN	BACKUP COOBOL/D	BACKUP/DEC
	DTR/DEC	DTR&FORTRAN	BACKUP COOBOL/D	BACKUP/DEC
	DTR/DEC	DTR&FORTRAN	BACKUP COOBOL/D	BACKUP/DEC
				ALLAN BRADLY
		IBM		IBM
				HP
		IBM		IBM
		IBM		IBM
				HP
				Y
				Y
				Y
				Y
				Y
				Y
				Y
			MAGSAV/LST/LOAD	LOAD/DUMP/LST
			MAGSAV/LST/LOAD	LOAD/DUMP/LST
			MAGSAV/LST/LOAD	LOAD/DUMP/LST
			MAGSAV/LST/LOAD	LOAD/DUMP/LST
			MAGSAV/LST/LOAD	LOAD/DUMP/LST
			MAGSAV/LST/LOAD	LOAD/DUMP/LST
	DTR/DEC	DTR&FORTRAN	BACKUP COOBOL/D	BACKUP/DEC
	DTR/DEC	DTR&FORTRAN	BACKUP COOBOL/D	BACKUP/DEC
	DTR/DEC	DTR&FORTRAN	BACKUP COOBOL/D	BACKUP/DEC
	DTR/DEC	DTR&FORTRAN	BACKUP COOBOL/D	BACKUP/DEC
			SPERRY	SPERRY
			SPERRY	SPERRY
			SPERRY	SPERRY
			SPERRY	SPERRY
			SPERRY	SPERRY
			SPERRY	SPERRY

SYSTEMS SOFTWARE: DATA MANAGEMENT SOFTWARE

LEGEND:

XXX / YYY = NAME / VENDOR
BLANK = NOT SPECIFIED
Y = YES BUT NOT SPECIFIED

DATABASE MANAGEMENT	DATA DICTIONARY	QUERY LANGUAGE	ARCHIVE	BACK-UP AND RESTORE
	DTR/DEC	DTR&FORTRAN	BACKUP COOBOL/D	BACKUP/DEC
			SPERRY	SPERRY
			SPERRY	SPERRY
	DTR/DEC	DTR&FORTRAN	BACKUP COOBOL/D	BACKUP/DEC
			SPERRY	SPERRY
			MAGSAV/LST/LOAD	LOAD/DUMP/LST
			SPERRY	SPERRY
			MAGSAV/LST/LOAD	LOAD/DUMP/LST
			MAGSAV/LST/LOAD	LOAD/DUMP/LST
			SPERRY	SPERRY
	DTR/DEC	DTR&FORTRAN	BACKUP COOBOL/D	BACKUP/DEC
			SPERRY	SPERRY
	DTR/DEC	DTR&FORTRAN	BACKUP COOBOL/D	BACKUP/DEC
ORACLE	INHOUSE	ORACLE	VAX/UMS	VAX/VMS
1032/SOFTWARE	1032/SOFTWARE	1032/SOFTWARE		
1032/SOFTWARE	1032/SOFTWARE	1032/SOFTWARE		
1032/SOFTWARE	1032/SOFTWARE	1032/SOFTWARE		
1032/SOFTWARE	1032/SOFTWARE	1032/SOFTWARE		
1032/SOFTWARE	1032/SOFTWARE	1032/SOFTWARE		
1032/SOFTWARE	1032/SOFTWARE	1032/SOFTWARE		
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.
ADABAS		NATURAL	DMS/OS	F.D.R.

SYSTEMS SOFTWARE: DATA MANAGEMENT SOFTWARE

LEGEND:

XXX / YYY = NAME / VENDOR
BLANK = NOT SPECIFIED
Y = YES BUT NOT SPECIFIED

DATABASE MANAGEMENT	DATA DICTIONARY	QUERY LANGUAGE	ARCHIVE	BACK-UP AND RESTORE
ADABASE				
ALADIN				
ARGOS	ARGOS	ARGOS	ARGOS	ARGOS
COMPTTECH/QMEO	SAME	SAME	SAME	MAGSAU/PRIME
COMPTTECH/QMEO	SAME	SAME	SAME	MAGSAU/PRIME
COMPTTECH/QMEO	SAME	SAME	SAME	MAGSAU/PRIME
COMPTTECH/QMEO	SAME	SAME	SAME	MAGSAU/PRIME
COMPTTECH/QMEO	SAME	SAME	SAME	MAGSAU/PRIME
CONCEPT/E.I.S.				
CONCEPT/E.I.S.				
CONCEPT/E.I.S.				
CONCEPT/E.I.S.				
CONCEPT/E.I.S.				
CONCEPT/E.I.S.				
CONCEPT/E.I.S.				
CONCEPT/E.I.S.				
DABSEII/A-TATE				
DATA PERFECT				
DATA PERFECT				
DATA PERFECT				
DATA PERFECT				
DATA PERFECT				
DATA PERFECT				
DATA PERFECT				
DATA PERFECT				
DBASE II				
DEC				DEC
DEC				DEC
DEC				DEC
DEC				DEC
DL/1				FDR
DMIV-TP(HONEYW)	HONEYWELL	HONEYWELL	HONEYWELL	HONEYWELL
DMIV-TP(HONEYW)	HONEYWELL	HONEYWELL	HONEYWELL	HONEYWELL
DMIV-TP(HONEYW)	HONEYWELL	HONEYWELL	HONEYWELL	HONEYWELL
DMIV-TP(HONEYW)	HONEYWELL	HONEYWELL	HONEYWELL	HONEYWELL
DMIV-TP(HONEYW)	HONEYWELL	HONEYWELL	HONEYWELL	HONEYWELL
DMIV-TP(HONEYW)	HONEYWELL	HONEYWELL	HONEYWELL	HONEYWELL
DMIV-TP(HONEYW)	HONEYWELL	HONEYWELL	HONEYWELL	HONEYWELL
DMIV-TP(HONEYW)	HONEYWELL	HONEYWELL	HONEYWELL	HONEYWELL
DMIV-TP(HONEYW)	HONEYWELL	HONEYWELL	HONEYWELL	HONEYWE
DMIV-TP(HONEYW)	HONEYWELL	HONEYWELL	HONEYWELL	HONEYWE
DMIV-TP(HONEYW)	HONEYWELL	HONEYWELL	HONEYWELL	HONEYWELL
DMIV-TP(HONEYW)	HONEYWELL	HONEYWELL	HONEYWELL	HONEYWELL

SYSTEMS SOFTWARE: DATA MANAGEMENT SOFTWARE

LEGEND:

XXX / YYY = NAME / VENDOR
BLANK = NOT SPECIFIED
Y = YES BUT NOT SPECIFIED

DATABASE MANAGEMENT	DATA DICTIONARY	QUERY LANGUAGE	ARCHIVE	BACK-UP AND RESTORE
HP	HP	HP	HP	HP
HP				HP
IBM/SQL	1032/SOFTWARE	IBM/ISQL	IBM/SQL	IBM/CMS,DDR,IDC
IBM/SQL		IBM/ISQL	IBM/SQL	IBM/CMS,DDR,IDC
IBM/SQL		IBM/ISQL	IBM/SQL	IBM/CMS,DDR,IDC
IBM/SQL		IBM/ISQL	IBM/SQL	IBM/CMS,ODR,IDC
IMABE/HP		QUERY/HP		SYSDUMP/HP
IMAGE/HP		QUERY/HP	MAG.TAPE/HP	MAG.TAPE/HP
IMAGE/HP		QUERY/HP	MAG.TAPE/HP	MAG.TAPE/HP
IMAGE/HP		QUERY/HP	MAG.TAPE/HP	MAG.TAPE/HP
IMAGE/HP		QUERY/HP	MAG.TAPE/HP	MAG.TAPE/HP
IMAGE/HP		QUERY/HP	MAG.TAPE/HP	MAG.TAPE/HP
IMAGE/HP	DIC3000/HP	QUERYB/HP		MPE V/HP
IMAGE/HP	IMAGE/HP	QUERY/HP	TF/HP	DBLOO,DBULD/HP
IMAGE/HP	IMAGE/HP	QUERY/HP	TF/HP	DBLOO,DBULD/HP
IMAGE/HP	IMAGE/HP	QUERY/HP	TF/HP	DBLOO,DBULD/HP
IMAGE/HP	DIC3000/HP	QUERYB/HP		MPE V/HP
IMAGE/HP	IMAGE/HP	QUERY/HP	TF/HP	DBLOO,DBULD/HP
IMAGE/HP	IMAGE/HP	QUERY/HP	TF/HP	DBLOO,DBULD/HP
IN HOUSE			IN HOUSE	IN HOUSE
IN HOUSE			IN HOUSE	IN HOUSE
IN HOUSE			IN HOUSE	IN HOUSE
IN HOUSE			IN HOUSE	IN HOUSE
IN HOUSE			IN HOUSE	IN HOUSE
IN HOUSE			IN HOUSE	IN HOUSE
IN HOUSE			IN HOUSE	IN HOUSE
IN HOUSE			IN HOUSE	IN HOUSE
IN-HOUSE		IN-HOUSE	IN-HOUSE	IN-HOUSE
IN-HOUSE		IN-HOUSE	IN-HOUSE	IN-HOUSE
INFO/HENCO;QUED	SAME,QUED/CMPTR	SAME		MAG-SAV&RST/PRM
INFORMAP/SYNERC	INFORMAP/SYNER			
INFORMAP/SYNERC	INFORMAP/SYNER			
INFORMAP/SYNERC	INFORMAP/SYNER		RMS/DEC	RMS/DEC
INFOSIID.GNRL		QUERY D.GNRL	IFILE D.GNRL	
MANAGE/CSC	MANAGE/CSC	MANAGE/CSC	CSTS/CSC	CSTS/CSC
MANAGE/CSC	MANAGE/CSC	MANAGE/CSC	CSTS/CSC	CSTS/CSC
MANAGE/CSC	MANAGE/CSC	MANAGE/CSC	CSTS/CSC	CSTS/CSC
MANAGE/CSC	MANAGE/CSC	MANAGE/CSC	CSTS/CSC	CSTS/CSC
MANAGE/CSC	MANAGE/CSC	MANAGE/CSC	CSTS/CSC	CSTS/CSC
MANAGE/CSC	MANAGE/CSC	MANAGE/CSC	CSTS/CSC	CSTS/CSC

SYSTEMS SOFTWARE: DATA MANAGEMENT SOFTWARE

LEGEND:

XXX / YYY = NAME / VENDOR
BLANK = NOT SPECIFIED
Y = YES BUT NOT SPECIFIED

DATABASE MANAGEMENT	DATA DICTIONARY	QUERY LANGUAGE	ARCHIVE	BACK-UP AND RESTORE
MBA				
MBA				
MBA				
MBA				
MBA				
MBA				
MBA				
MBA				
MDS	MDS	MDS		MDS
MDS	MDS	MDS		MDS
OEM	OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM	OEM
OEM	OEM	OEM	OEM	OEM
RADIOSHACK	RADIOSHACK			
SIR/DBMS	SIR/DBMS	SIR/DBMS	SIR/DBMS	SIR/DBMS
SIR/DBMS	SIR/DBMS	SIR/DBMS	SIR/DBMS	SIR/DBMS
SIR/DBMS	SIR/DBMS	SIR/DBMS	SIR/DBMS	SIR/DBMS
SIR/DBMS	SIR/DBMS	SIR/DBMS	SIR/DBMS	SIR/DBMS
SPERRY			SPERRY	SPERRY
SSP	SSP	SSP	SSP	
SSP	SSP	SSP	SSP	
SSP	SSP	SSP	SSP	
SSP	SSP	SSP	SSP	
SSP	SSP	SSP	SSP	
Y		Y	Y	Y
ADABAS				
ADABAS				
ADABAS				
ADABAS				
ADABAS				
IBM	IBM	IBM	IBM	IBM
IBM	IBM	IBM	IBM	IBM

SYSTEMS SOFTWARE: DATA MANAGEMENT SOFTWARE
LEGEND:

XXX / YYY = NAME / VENDOR
BLANK = NOT SPECIFIED
Y = YES BUT NOT SPECIFIED

DATABASE MANAGEMENT	DATA DICTIONARY	QUERY LANGUAGE	ARCHIVE	BACK-UP AND RESTORE
IBM	IBM	IBM	IBM	IBM
IBM	IBM	IBM	IBM	IBM
IBM	IBM	IBM	IBM	IBM
IBM	IBM	IBM	IBM	IBM
IMAGE/HP	DCTNRY3000/HP	QUERYB/HP		MPEV/HP
IN HOUSE				IN HOUSE
IN HOUSE				Y
IN HOUSE				IN HOUSE
IN HOUSE				IN HOUSE
IN HOUSE				IN HOUSE
INGRES/RELTEC				VMS/DEC
INGRES/RLTNL		DATATRIEVE/DE		
INGRES/RLTNL		DATATRIEVE/DE		
INGRES/RLTNL		DATATRIEVE/DE		
SPEED/TOM				
SPEED/TOM				
SPEED/TOM				
SPEED/TOM				

APPENDIX 5

GENERAL COMMENTS, PURCHASE INTENTIONS
RESPONSES TO QUESTIONNAIRE

RUNNING COUNT	PURCHASE COMM
1	'$8MM BUDGET/YEAR,INFORMATION SERVICES DIV.'
2	ORDIN.(MAI)INCLUANT LE LOGICIEL PREVU AU 85.CONSEILLERS AU RECOMM-SYST.APPROPRIE
3	DISK DRIVES
4	ADD BLOCK MODEL,CONTOUR,GRAPHIC,& MINE PLANNING SOFTWARE
5	ADI CADD SOFTWARE
6	ADD PRINTER & DISK WITHIN A YR/ADD WORD PROCESS SOFTWARE
7	ADD TTY EMULATOR SOFTWARE/COMMUNIC NETWORK WITH MF COMP
8	BUDGET $1MM FOR NEXT 3-5YR FOR SOFT/HARD PURCH ON CADD/PLOT/COMMU
9	BUILD UP SOFTWARE & TRAIN END USERS
10	BUY CAD/CAM HARD/SOFTWARE NEXT 18 MONTH
11	BUY MAGTAPE DR/MEM TO 1MB/PLOTTING SOFT GKS STD & FOR VAX11/750
12	CENTRALIZED EXIST IBM SY38 & HP3000, NO OTHER PLANS
13	CHANGE TO MICRO-COMPUTER,SOFTWARE ARE UP FOR REVIEW
14	COAL SCIENCE GR. DO RESEARCH ON COAL PETROLOGY DONT HAVE RELEVANT SOFTWARE
15	COMPANY WIDE HARDWARE/SOFT REQUIRMNTS AND ACQUISTN POLICY UNDER STUDY
16	CON SY34 TO SY36 FOR ACCOUNT/DATA PROC BY PARENT COM ON SERV. BUREAU/CON IBM4341 TO SY36 @ MINE SIT
17	CONT TO DEV DB SYS FOR MINING FROM EQ SEL TO OP PRACTICE
18	CONT UPGRADE IBM PC
19	CONV LONGTERM STRATEGY TO MICRO/KEEP GRAPHIC ON TIME SHARED MAINFRAM
20	CURRENTLY CONSIDERING UPGRADNG OF MAINFRAME PROC-CAPACITY BY FIELD UPGRADE OF EXISTING OR REPLACMNT
21	DATA MANAGEMENT VIA SERVICE BUREAU ONLY
22	DECISION ON COMPUTER AFTER OP. RESUMED
23	DEV MARKETING AGREEMENT WITH HARDWARE SUPPLIERS
24	DEV SOFT/HARDWARE INHOUSE FOR MINING CO BASED ON INTEL8085 M/PS
25	DOES COAL RELATED RES./DOES NOT DEAL WITH MINING
26	DOESN'T DEAL WITH MINING
27	DOESN'T DEAL WITH MINING/2 CLIENTS DOING OIL EXP/OP STUDIES
28	DONT KNOW WHAT IS NEEDED & WANTED
29	DON' OPER. COAL PROJ./HARDROCK HANDLED BY B.ROSS @ 4600 TD CENTER,TORONTO
30	EVENTUALLY WILL LINK PLOTTER&DIGITZR TO MTS(U OF A),HAS HP TERMINAL,WOULD CONVERT IF SUFFICIENT SYS
31	EXP MEMORY STORAGE CAP TO 128K
32	GEOSTAT /FIN & ACCT /OBTAINED , COAL MINING BY CONTRACT CO
33	HARD/SOFTWARE EVAL. IS 90% COMP. WILL IMPL SOON

RUNNING COUNT	PURCHASE COMM
34	HAVE 2 HP1000 FOR PROC CONT/WANT DRAGLINE MONITOR SYS/INCR MEMORY TO 1MEG
35	HAVE A COMMITTE TO DET SOFT/HARDWARE NEEDS
36	HAVE FINANCIAL SOFT/MINING SOFT NEXT
37	HAVE MICRO/PRINTER FOR ACCOUNTING,WILL ADOPT AVAIL. MINING SOFT TO MICRO
38	INACTIVE IN MINING AT PRESENT
39	INCR IBM PC FOR ACCOUNT/BUDGET
40	INCR MEMORY CAP TO 60 MEG BYTE
41	INCR MEMORY STORAGE TO 6M
42	INCR MEMORY TO 4 MEG/EX DIGITAL SIGNAL PROC & PROGRAMMING SOFTWARE TOOLS
43	INCR OFFICE AUTOMATION IN ACCOUNT/WORD PROC
44	INCREASE MEMORY CAP TO 1 MB
45	LEASE/PUR. MINI FOR EXPL W/SOFT / SUR/UG MINE PL/GEOL SOFT NEXT
46	LIKE TO HAVE A CATALOG OF AVAL. SOFTWARE
47	LOOKING FOR SOFTWARE
48	MEMORY CAP TO 256K/WORD PROC & SPREAD SHEET SOFTWARE
49	NEED SOFT. FOR HR-MINING NEXT YR./LISA IS FOR DB MGN,FINANCIAL,& OFFICE MGN
50	NO FUTURE PLANS TO REENTER FIELD OF CANADIAN MINING SOFTWARE MARKET
51	NO PLAN FOR FUTURE
52	NO PLAN TO PURCH IN NEAR FUTURE
53	NO PLANS TO UPGRADE HARD/SOFTWARES REF TO MINING APPL.
54	NO PURCH HARD/SOFT FOR MINING APPLICATN
55	NO PURCHASES INTENDED
56	NO SOFT PURCH/BUY 32 BIT MACH & COLOR GRAPHIC TERM./INCRE MEM CAP TO 50MEG
57	OUR COMPTR WORK IS PRIMARY FOR OIL&GAS PRODUCTION ROYALTIES
58	PROD/PROC/ADM BECOME A STANDALONE ENVIRO
59	PROGRAM TO PURCHASE 1-MICROCOMP & PRINTER/APPLICATION
60	PURCH DEPEND ON DEMAND
61	REGULATED BY PARENT CO
62	REPLACE SY/34 WITH FASTER IBM/HP/DEC C/W SOFTWARE WITHIN 12 MONTH
63	SOFT FOR GEOTECH/HYDROGEO IN NEXT 12 MONTHS
64	STATES SEVERAL PROGRMS WILLBE AVAILBL TO HANDLE COMPLETE EXPLORTN PROGRMS BY MICROS.WILLBE WAITING
65	STUDY IS ABOUT TO BE UNDERTAKEN TO DETERMINE DEPARTMNT REQUIRMNTS.CHANGES TREND TO BE IN D.M
66	SYS IS BEING DEV/NO PLAN FOR EXPANSION
67	USE DALHOUSIE, CYBER,ADD WORK ST.& GRAPHIC TERMINAL
68	WANTS TO USE COMPUTER IN FUTURE/ Q? SOFTWARE AVAILABILITY
69	WILL INSTALL DEDICTED COMM LINE,INTERCTV SOFTW UNDER DEVELOPMNT,PLOTTER,DIGITZR,PRINTR ON ORDER
70	WILL PURCH MS-DOS COMPATABLE SOFTWARES
71	WILL UPGRADE HP,APPLE,TRS,WANG HARD/SOFTWARES